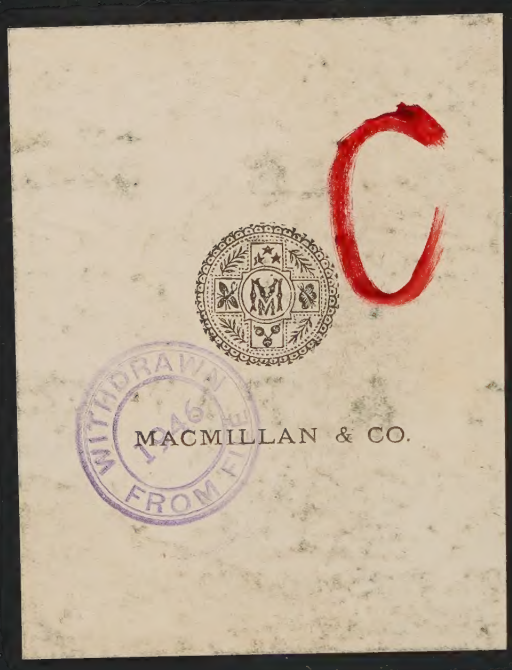
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MICRO-PHOTOGRAPHS

IN

HISTOLOGY,

NORMAL AND PATHOLOGICAL.

BY

CARL SEILER, M.D.,

IN CONJUNCTION WITH

J. GIBBONS HUNT, M.D., AND JOSEPH G. RICHARDSON, M.D.

LONDON:

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MICRO-PHOTOGRAPHS IN HISTOLOGY.

PROSPECTUS.

THIS publication is intended to replace the microscope, as far as is possible, for those physicians who have neither opportunity nor leisure to make observations with the instrument for themselves, and also to furnish microscopists, for comparison, correct representations of typical specimens in the domain of normal and pathological histology.

As the pictures are obtained directly from the microscopic objects by means of photography, and printed from the negative by a reliable mechanical process, they have the great advantage of being faithful copies of the pictures formed by the lens, and there is nothing produced that is not actually visible in the instrument, thus avoiding the diagramatic character and the subjective coloring which are so frequently found in drawings made by means of the camera lucida. In fact, the illustrations used in the lecture-room and found in books are idealized so much as rarely to give an exact impression of the specimen as it really exists.

The student accustomed to such diagrams is, therefore, often very much disappointed when, in looking at the specimen itself, he sees at first nothing but a mass of fibres and granular material, in which only after careful study he discovers the outlines of cells that he expected to see at once sharply defined. In the plates of this work, and especially in those of pathological specimens, the same holds good; and the student who is not a practiced microscopist must study them carefully, as the investigator studies the preparation itself, before they can be thoroughly understood and judgment passed upon them.

The process to be used in printing our plates ensures more sharpness and distinctness than even the ordinary silver-print, and is preferable for other reasons.

The plan of the publication has been decided upon after consultation with Drs. Joseph Leidy and S. Weir Mitchell and other gentlemen of high standing in science; but it, as well as the selection of specimens, is principally due to the judgment of Drs. J. Gibbons Hunt and Joseph G. Richardson. The photographs are to be carefully prepared by myself, and will be accompanied by a few pages of text fully describing each plate, indicating the particular points of interest, and showing the connection and analogy of the different specimens. The text, prepared under the supervision of Drs. Richardson and Hunt, will be strictly descriptive and explanatory, dealing only in facts and setting forth no unacknowledged theories.

It is purposed to give in each monthly issue pictures of at least one pathological and three normal specimens, to illustrate the differences between healthy and diseased structures. In this way we offer a clear insight into the nature of the pathological formations, as revealed by the microscope.

As some of the tissues of the human body cannot be obtained fresh enough for microscopic purposes, specimens from the lower animals will be substituted when necessary, as is so frequently done in histological studies. We will, however, exercise due care to use only the best and most typical examples.

We shall also use that magnifying power which possesses the greatest advantages, even if some minor details are sacrificed. The object is not to magnify as highly as possible, but to produce a picture that will give the clearest attainable idea of the nature of the specimen. Of course the lower the power, so that it brings out all desired features, the more distinct the picture.

Since this is the first time that a systematic publication of micro-photographs has been undertaken, and I have the valuable aid of my associates, I feel at liberty to express confidence that the work cannot fail to be useful not only to the general practitioner, but also to the scientific world at large.

CARL SEILER.

PHILADELPHIA, April, 1876.

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PLATE I.

SECTION OF SKIN,

Transversely through the Hair Bulbs.

80 Diameters.

FRENCH SPECIMEN.

PHOT., C. SEILER, M.D.

PLATE II.

EPITHELIOMA OF LOWER LIP.

80 Diameters.

SPECIMEN FROM U. S. A. MED. MUSEUM.

PHOT., C. SEILER, M.D.

PLATE I.

SECTION OF SKIN.

This plate shows a section of skin cut parallel to the surface, and consequently transversely, through the hair-bulbs. A specimen of this kind enables us to observe the arrangement of the different tissues which enter into the construction of the integument. The circular patches, showing a dark margin and opaque centre, represent the hairs cut transversely. The hair, being of a dark, non-actinic color in the specimen, prevented any light from passing through, and thus produced the black spots in the print. These hairs are surrounded by several layers of epithelial cells, which are indicated by the lighter halo around the dark centre. The margin is again, dark, being more deeply stained by carmine in the specimen, and consists of connective tissue fibres.

The areas between the hairs are seen to be chiefly filled with oval fat-cells, the darker bands running in different directions being bundles of connective tissue fibres.

In the upper left-hand side of the plate an artery is seen, with its transverse muscular coat indicated by the circular striæ.

The specimen from which the negative was made is a French carmine staining mounted in balsam, and is in the possession of Dr. Hunt.

PLATE II.

EPITHELIOMA.

This plate represents also a parallel section of skin transversely through the hairs, like Plate I., but in a diseased state. We see here no fat-cells nor broad bands of connective tissue, and find that the hairs have evidently been compressed by the increase of the number of epithelial cells surrounding them. This obliteration of the fat and connective tissue has been produced by the abnormal infiltration of epitheloid cells, which are seen to aggregate in different places, and thus form the so-called cell-dépôts of cancer (Rindfleisch).

In some parts of the plate the course of the connective tissue fibre bundles can be traced for some distance, but is then lost sight of in the mass of cellular elements.

In the specimen from which this plate was made the hairs were lighter than in the specimen of Plate I., and therefore show more details—such as, for example, their medulla.

The object is a carmine staining, prepared at the Army Medical Museum at Washington, and is in the possession of Dr. Hunt.

PLATE III.

PAVEMENT EPITHELIUM.

This plate shows one of the forms of epithelium—the tessellated or pavement epithelium—in which the cells are arranged like bricks upon a sidewalk. The nuclei of the cells are distinctly seen, having been deeply stained in the specimen; but the peripheral outlines are somewhat faint, owing to the fact that they were but slightly colored, and could only be brought into view in the negative by photographing them when a little out of focus. In some of the cells a granular deposit is noticed; and in others, at the top of the plate, a multiplication of the cells by division may be observed. One of the cells has two nuclei completely separated, while alongside of it there is one of the same shape and size, but with a division-line between the nuclei.

The specimen is a hæmatoxylon staining, and was prepared by Dr. Hunt.

PLATE IV.

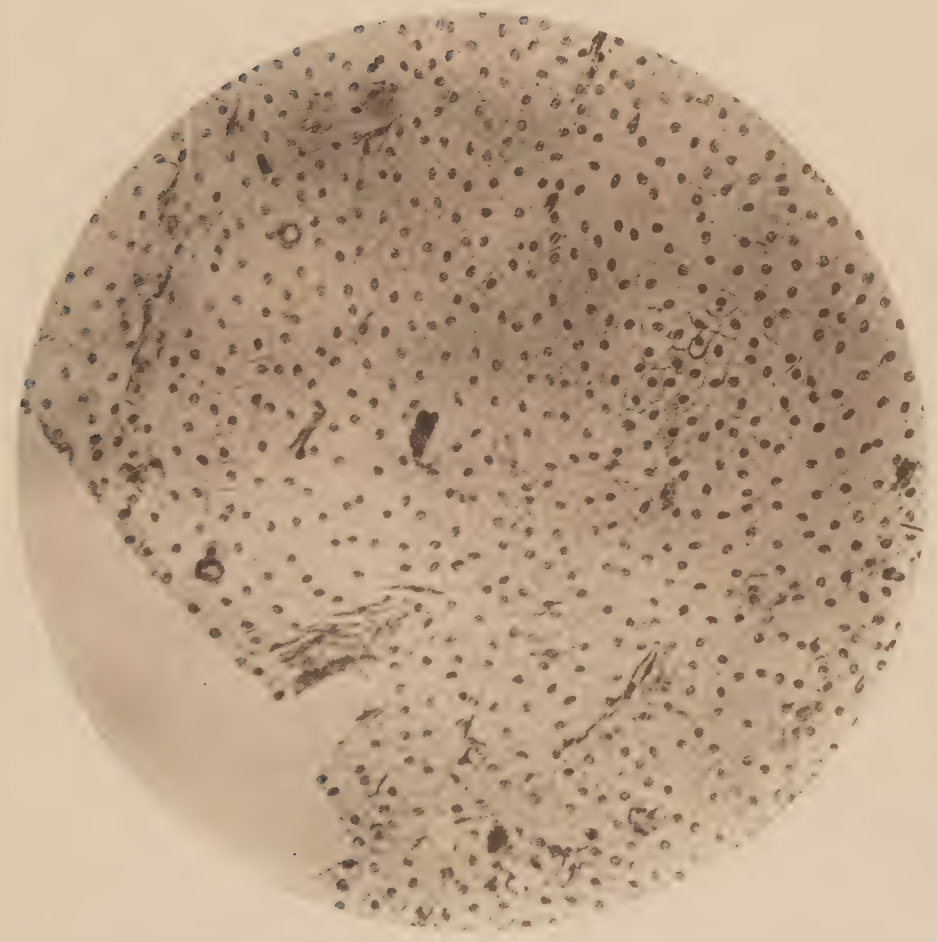
ENDOTHELIUM.

Endothelium—which, as its name implies, is distinguished from epithelium by being on the inner surface of closed cavities—is found lining the blood-vessels and serous sacs of the body. The constituent cells form a delicate pavement-like layer, which is, however, not visible unless stained with either silver or gold solution.

In the plate we see this stratum of cells covering the parts beneath. In many places the outlines of its cellular elements are sharp and distinct, while in others they are slightly out of focus, owing to the inequality in the thickness of the specimen. The dark bands shining through the endothelial coat are muscular fibres, vessels and bundles of connective tissue.

The specimen—a silver staining—was prepared at the Army Medical Museum at Washington, and was obtained from J. W. Queen & Co.

PLATE III



PAVEMENT EPITHELIUM,

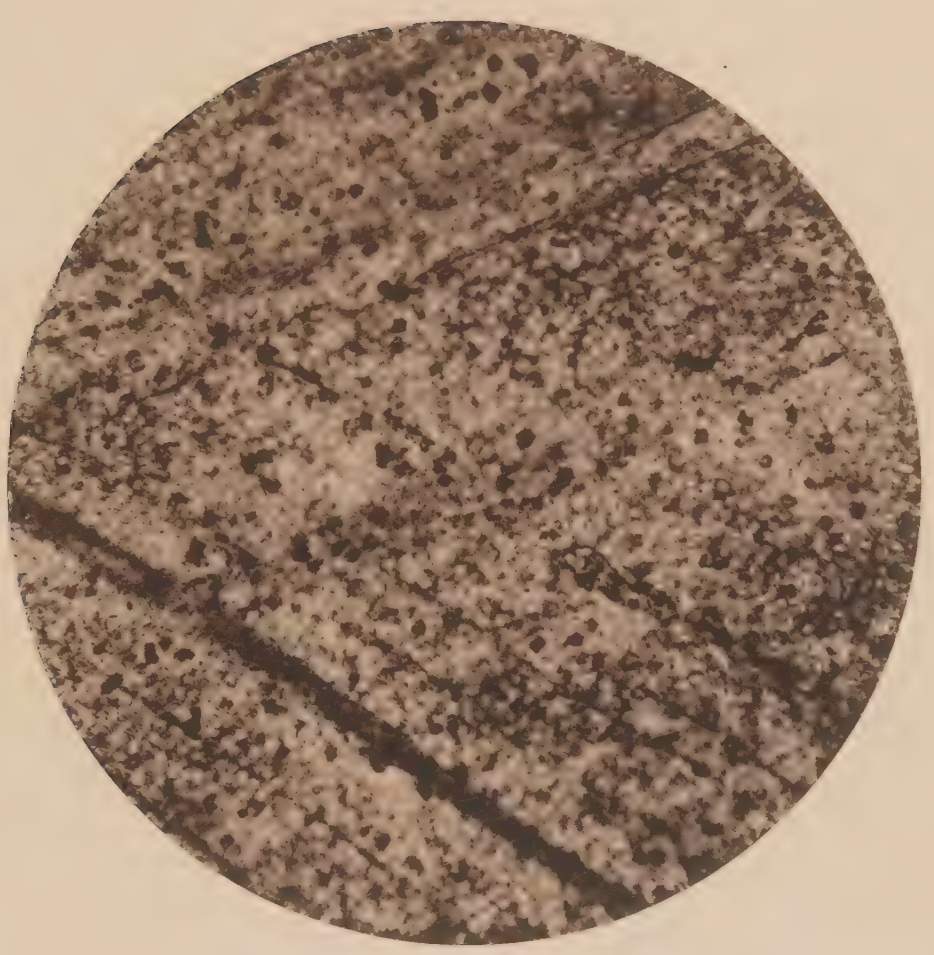
From a Triton.

80 Diameters.

SPECIMEN FROM J. G. HUNT, M.D.

PHOT., C. SEILER, M.D.

PLATE IV.



ENDOTHELIUM,

From Diaphragm of a Guinea-pig.

80 Diameters.

SPECIMEN FROM U. S. A. MED. MUSEUM.

PHOT., C. SEILER, M.D.

PLATE V.

ELASTIC CONNECTIVE TISSUE.

120 Diameters.

Specimen from J. G. Hunt, M.D.

Phot., C. Seiler, M.D.

PLATE V.

ELASTIC CONNECTIVE TISSUE.

The large group of tissues embraced by modern histology in the "connective tissue" series presents great diversity in appearance, and some technological skill to obtain typical specimens of the principal kinds is required.

Under the microscope the ordinary observer often fails to see the delicate fibres or cells composing the tissues of this class. But some acquaintance with their morphology is desirable for all, and indispensable to those who would have any scientific conception of animal structures.

They are tissues of low rank, seldom taking active part in the higher physiological processes, while they penetrate, surround and support every organ of the body, constituting a framework holding all together, as their name implies. They form tissues in which glands, nerves, muscles and vessels are imbedded or find passage from part to part.

Examples.—Common connective tissue, fascia, tendons, fat, vitreous humor, cartilage, bone, dentine, etc.

We offer the following brief but comprehensive classification of this group:

1st. Fibrous connective tissue.—*Example,* duramater, pericardium, skin, sub-mucous and sub-serous surfaces, tunica adventitia of vessels, intestines, tendons, etc.

Varieties of fibrous connective tissue: (*a*) *Elastic.*—Fibres do *not* swell in acid. *Example,* pericardium, etc. (*b*) *Non-elastic.*—Fibres *do* swell in acid. *Example,* omentum.

2d. Reticular connective tissue.—*Examples,* in lymphatic glands, spleen, kidneys, etc.

3d. Gelatinous connective tissue.—*Examples,* vitreous humor, umbilical cord.

The plate shows the general direction and distribution of these elastic fibres. Running in all directions, often inosculating, as may be clearly seen in the mesentery of the rabbit, transparent as fibres of glass, and therefore optically differentiated with some difficulty, presenting no marked structure, with individual fibres often less than the one five-thousandth of an inch in diameter, the photograph shows such a featureless tissue

about as well as it is seen under most microscopes. The transparency of the fibres is in a measure obtained if the plate be examined by transmitted light.

The object is a hæmatoxylon staining prepared by Dr. Hunt.

PLATE VI.

SCIRRHUS OF MAMMARY GLAND.

In a specimen of scirrhus it is as important to demonstrate clearly the connective tissue fibres as it is to detect the cellular elements, because it is the abnormal development in quantity and density of these fibres which gives hardness to this kind of tumor.

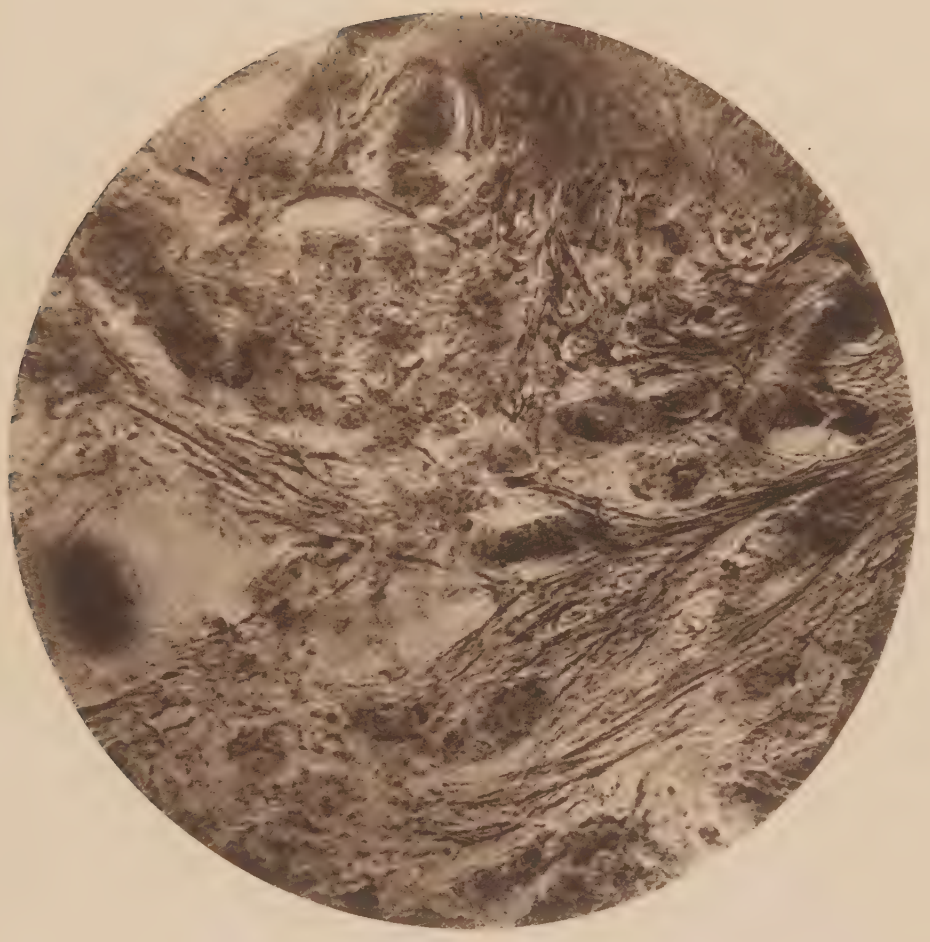
The plate shows that the elastic fibres are multiplied in number and have attained greater magnitude than in healthy tissues. Strong bands, made up of many filaments united, penetrate true scirrhus in all directions, opening at irregular intervals into cavities of various forms, which are filled with the cellular elements of such tumors. In some specimens of scirrhus these inter-fibular cavities are quite regularly cylindrical or columnar in form, so that the contained cells, closely approximated, resemble columns which have been broken and now lie fallen, the wreck of the normal tissue (*Rindfleisch*). This appearance is faintly indicated in parts of the specimen given.

Pathology adds no new morphological elements to the body; it changes pre-existing types in obedience to laws which we cannot interpret; therefore we detect no pathognomonic cells in any type of cancer. In true scirrhus, as the plate shows, no isolated cell could be differentiated optically from a pus cell; and yet the scirrhus cell develops life phenomena widely differing from recognized pus cells. Wide differences exist in the life-function of the living units of organization, which neither chemistry nor optics can reveal.

In studying all degenerated tissues the student should obtain as large a section as possible, because thus he can best study the educational gradations from healthy to diseased parts.

The specimen is a section from a scirrhus of the breast, stained with hæmatoxylon, and prepared by Dr. Hunt.

PLATE VI.



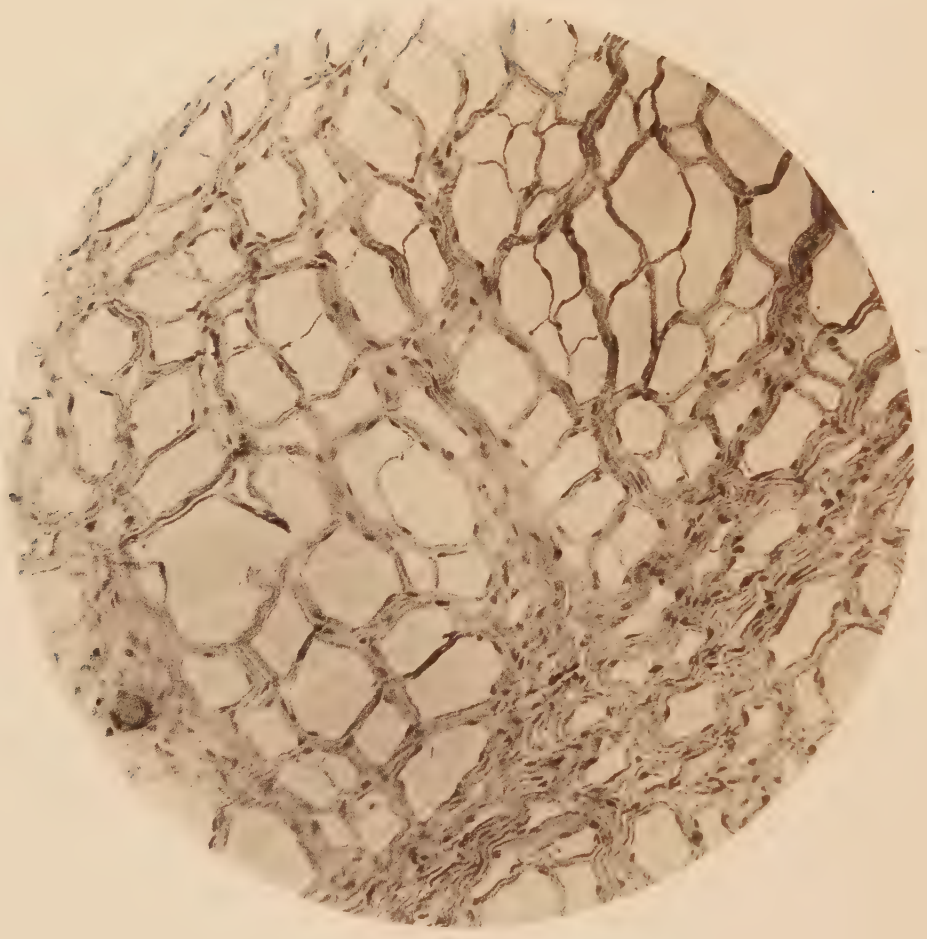
SCIRRHUS OF MAMMARY GLAND.

180 Diameters.

Specimen from J. G. Hunt, M.D.

Phot., C. Seiler, M.D.

PLATE VII.



NON-ELASTIC CONNECTIVE TISSUE,

From Omentum of a Cat.

80 Diameters.

SPECIMEN FROM C. SEILER, M.D.

PHOT., C. SEILER, M.D.

PLATE VII.

NON-ELASTIC CONNECTIVE TISSUE.

The plate shows that type of connective tissue formerly known as *areolar* tissue on account of the large open spaces between the fibres. Its histological elements, as indeed in other types too, are fibres and cells, of which, however, only the nuclei can be distinguished. It is the relationship of these elements which the plate exhibits. Fasciculi of numerous delicate non-elastic fibres anastomose in every direction and at every angle, spread out only laterally so as to form a membrane in the omentum, bounding areola of varying size. These areola are clear spaces not occupied by any tissue, however delicate, thus giving an example of net-like strength of tissue with greatest economy of material.

Although in general terms each fibre is non-elastic, yet, from its typical and unique anatomy, the tissue itself becomes very highly elastic, and is wonderfully adapted to its cushion-like function of protecting the intestines from injurious concussions. This great elasticity of the tissue, however, makes it exceedingly difficult to mount a specimen sufficiently flat to allow the whole of the field of the microscope to be in focus. The plate shows in some places a want of sharpness, the fibrous character being lost in a misty appearance, in which the nuclei are less distinctly seen than in other parts; this is owing to a slight elevation of the object in these misty places which threw them slightly out of focus.

Where the fibres are aggregated in largest number, the blood-vessels, nerves and lymphatics find transit through the tissue, and often in such places fat-cells abound.

The nuclei of many cells are apparent on the fibres, but in only the embryonic state of this tissue is it easy to demonstrate the entire cell-form. The omentum of the cat is chosen to illustrate this particular kind of connective tissue, because it exhibits all the typical elements with great clearness, and because it can be obtained fresh for staining. If allowed to remain unstained for only a few hours, it becomes a difficult matter to prepare it satisfactorily, and for this reason a specimen from the human body is not easily to be had.

This specimen is a hæmatoxylon staining prepared by Dr. Seiler.

PLATE VIII.

CONNECTIVE TISSUE CORPUSCLES.

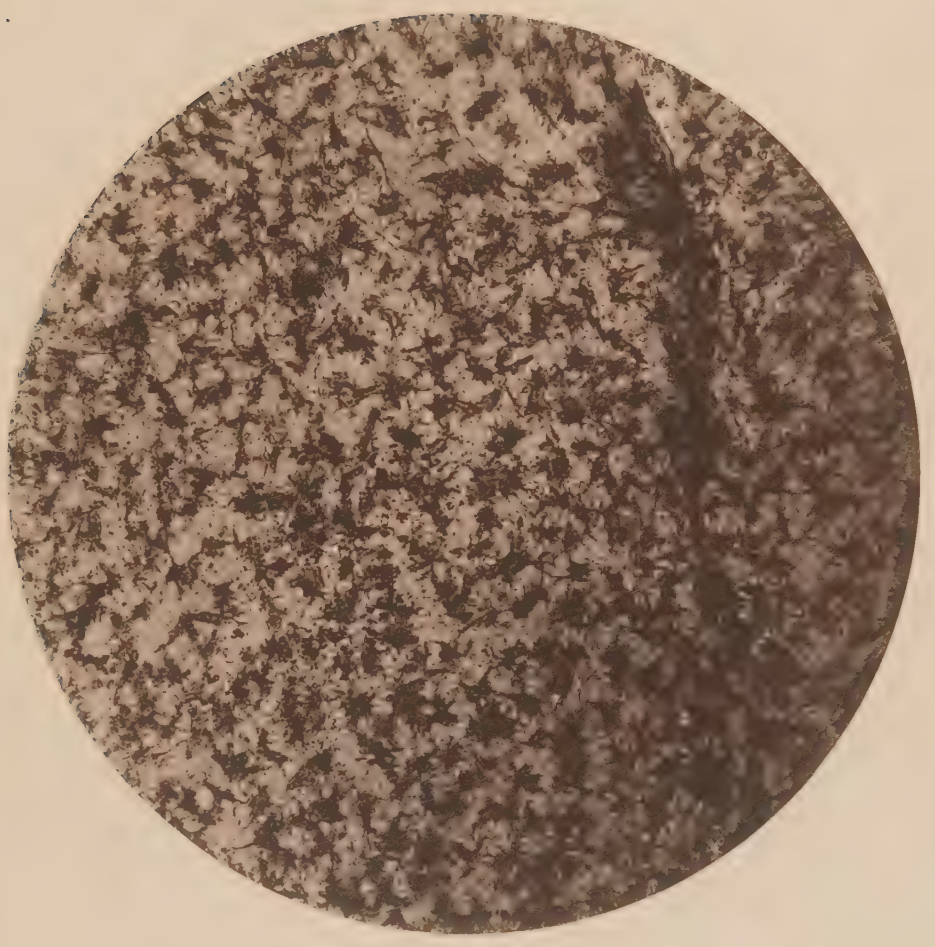
This plate shows the so-called connective tissue corpuscles as they appear in the cornea of the frog, rendered visible after treatment with chloride of gold. They resemble, as is seen in the plate, pigment-cells, which exist in other tissues than the cornea in all batrachians. The specimen here given is taken as showing most clearly the distinctive characteristics which mark these corpuscles in the tissues of all animals. The dark band seen in the right-hand side of this plate is a minute fold in the specimen. It entirely obstructed the light, because the opaque corpuscles are very close together and overlap each other. The mottled appearance of the spaces between the corpuscles is due to a slight deposit of the oxide of the metal in the matrix, which is almost unavoidable both in gold stainings and in silver stainings.

These corneal connective tissue cells are imbedded in the cornea, varying in size as much as they do in form. Often straight canals or branches radiate irregularly from each cell and join with other apparently similar canals from neighboring cells, until the entire cornea is interpenetrated with a complex system of cells and canals. During life these corpuscles are nearly or entirely transparent, though it is not probable that the protoplasm filling them is identical in structure with the enveloping tissue, or it would not alone respond to the gold treatment while all other parts remain unaffected. Accurate observations in the living condition are still needed on the contents of these corneal corpuscles to ascertain their relation, if any, to the physiology of vision. The treatment by gold obliterates normal structural conditions of the living protoplasm, while it reveals only the form and relationship of the cells. The existence of these corpuscles in this position, where we would have suspected a homogeneous tissue, is very suggestive to the histologist.

Other forms of connective tissue corpuscles are readily studied in the embryonic tissues while quite fresh, and after staining with neutral transparent colors, but only when kept immersed, or preserved in aqueous media. In such preparations the different stages of development of the corpuscles, from a simple cell up to the matured multipolar corpuscles, can easily be observed.

The object from which this plate was made is a section of the cornea of a frog treated with chloride of gold, and prepared at the U. S. Army Medical Museum, at Washington.

PLATE VIII.



CONNECTIVE TISSUE CORPUSCLES,

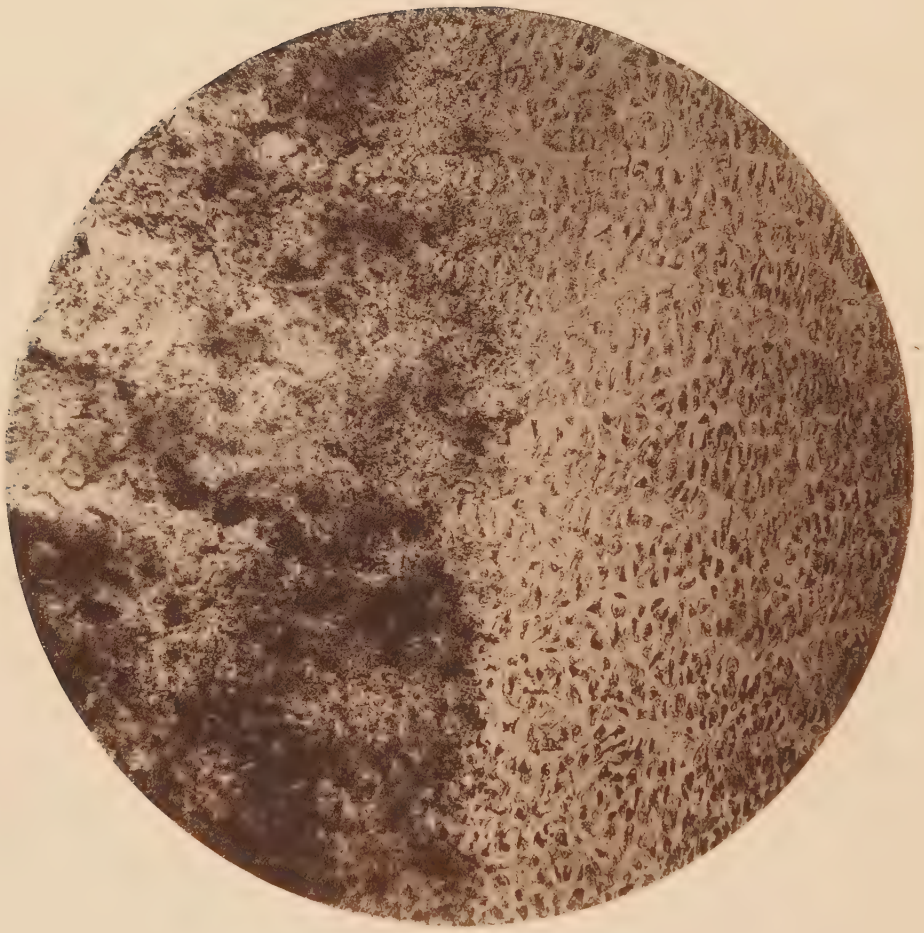
From Cornea of a Frog.

120 Diameters.

SPECIMEN FROM U. S. A. MED. MUSEUM.

PHOT., C. SEILER, M.D.

PLATE IX.



LONGITUDINAL SECTION OF FEMUR

Of Human Fœtus, Five Months' Old.

120 Diameters.

PREPARED BY J. G. HUNT, M.D.

PHOT., C. SEILER, M.D.

PLATE IX.

DEVELOPMENT OF BONE.

This plate illustrates one of the modes in which bone is developed. Bone as well as cartilage belongs to the large group of structures whose office it is to connect and give firmness to the different organs. On page 5 we have given a short classification of the different forms of connective tissue, and the most important of these forms are already depicted in the plates. We now give pictures of two other kinds of connective tissue, bone and cartilage, and also a peculiar pathological formation (enchondroma) which is identical with the latter.

In examining Plate IX., and also the specimen from which it was taken, we find that there is no line of demarkation between the cartilage on the one hand and bone on the other, but that the two tissues more or less completely run into each other. On the right side of the plate the cells of cartilage are seen to be crowded together, and are separated by but small spaces. They gradually grow larger and have more of the structureless matrix between them as they approach the boundary of the newly-formed osseous structure. There the cartilage cells gradually disappear, together with the matrix, being transformed into the medullary substance of bone. Some of the cartilage cells seem to resist this change longer than others, and we see rows of them extending unaltered far into the medullary substances, as, for instance, near the top of the plate. The specimen is injected with Prussian blue, and the injecting material has penetrated the newly-formed canals and vessels; and it will be observed in examining the plate that the unchanged cartilage is destitute of any blood-vessel system, the vessels of the bone stopping short at the boundary-line.

In Stricker's *Manual of Histology* a cut may be found representing the same development of bone, but more highly magnified and very diagramatic in its character. The specimen from which this plate was obtained is a longitudinal section of the femur of a human fœtus five months old, and was prepared by Dr. Hunt. It is a blue transparent injection stained with hæmatoxylon, mounted in glycerine.

PLATE X.

ENCHONDROMA.

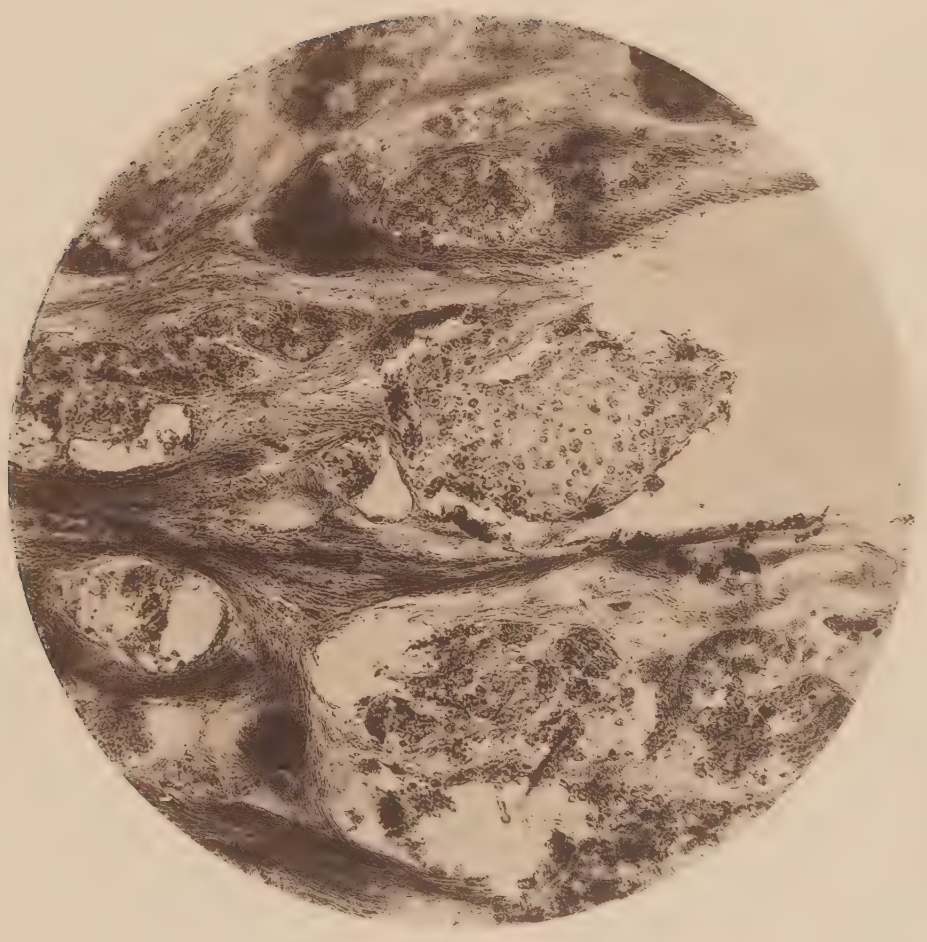
Rindfleisch, in his *Pathological Histology,* defines enchondroma, or cartilaginous tumor, as follows: "When cartilaginous tissue appears in the form of a tumor at a spot where, under normal circumstances, there should be no cartilage, we call it *enchondroma.*" This form of neoplasm, therefore, is true cartilage of either the fibrous or hyaline kind, and can readily be recognized by its elastic hardness and the milk-white translucent color which thin slices cut from the growth present. The microscopic appearance of this pathological formation is, as the plate quite distinctly shows, that of cartilage embedded in, and surrounded by, the normal tissue of the organ in which the tumor is developed. The plate shows a large unbroken mass of cartilaginous tissue—in this case hyaline—near the centre, with muscular fibres above and below. The striæ of the fibres were unfortunately not visible in the specimen. On the left side of the plate nests of cartilaginous cells are seen pushing the fibres asunder, while in the lower part, on the right hand side, a collection of cells seems to have been encysted, as a distinct wall is seen around its upper part. The tumor from which the specimen was prepared occurred in the thigh of an old man who was operated upon in the hospital at Vienna.

"Enchondroma generally occurs in connection with various bones, and occasionally with fibrous textures not in connection with bone." (*Beale.*)

Thin sections of the tumor can easily be made with a sharp razor, and if fresh can readily be stained with carmine. Gold or silver, however, is said to bring out the cellular character of the cartilage more distinctly than carmine or any of the other staining fluids. A most beautiful preparation of such a pathological specimen may be made by double staining, thus differentiating the various elements of the tissue by different colors, and not only by a varying intensity of one color. The aniline colors, together with hæmatoxylon, gold, silver or carmine, may be used with advantage for this process of staining.

The specimen from which the plate was made is a carmine staining prepared by Dr. Seiler, mounted in balsam.

PLATE X.



ENCHONDROMA,

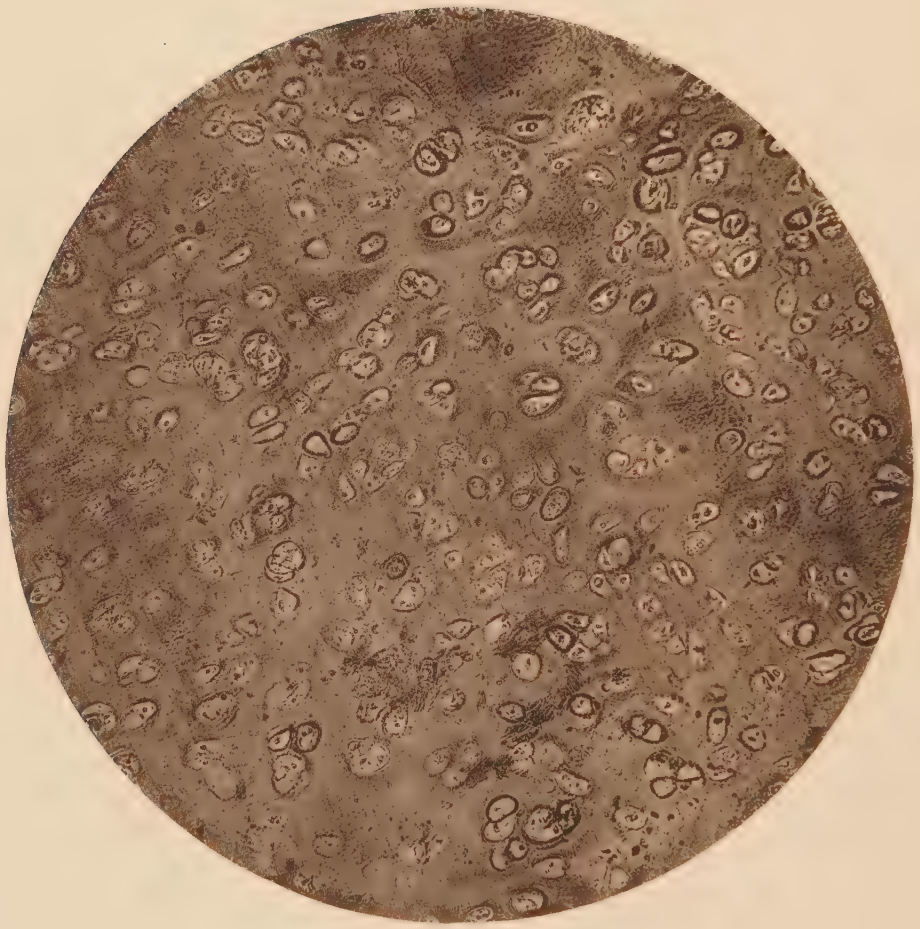
From the Thigh.

120 Diameters.

PREPARED BY C. SEILER, M.D.

PHOT., C. SEILER, M.D.

PLATE XI.



HYALINE CARTILAGE,

From Thyroid Cartilage of Human Larynx.

180 Diameters.

PREPARED BY C. SEILER, M.D.

PHOT., C. SEILER, M.D.

PLATE XI.

HYALINE CARTILAGE.

The histologist recognizes three different forms of cartilage—viz., hyaline cartilage, fibrous cartilage and stellate cartilage.

Hyaline cartilage consists of a homogeneous translucent *matrix*, in which the cells are embedded. These cells are of various sizes and shapes, and have, besides the cell-wall, a capsule, within which the reproduction of the cells by division and subdivision may readily be observed. The plate shows these cells with their nuclei, and in many cases their capsules. They do not occur in close contact with each other, as do the cells of other tissues, but are widely separated by the matrix. In many of the cells in the plate a multiplication of the nuclei may be observed, some containing two, others three and four nuclei, while in some a division-line between the nuclei not yet completely separated can be seen. The specimen was obtained from the thyroid cartilage of a human larynx, which, as Luschka has discovered, contains both the hyaline cartilage in the lateral plates and the fibrous cartilage in the small intermediate plate. This intermediate plate of the larynx is situated at the anterior angle of the thyroid cartilage, and is shaped like a bottle; to it the vocal cords are attached. By making a thin section across this plate and part of the two lateral plates a specimen showing both the hyaline and the fibrous cartilage side by side may be obtained. In staining thin sections of cartilage it is very important to have the matrix merely tinged with the color used, while the cells, and especially their nuclei, should be deeply stained, as otherwise an indistinct and ill-defined picture is seen in the microscope. This holds good not only for cartilage, but also for other tissues.

In fibrous cartilage the matrix is not homogeneous, but exhibits under the microscope a fibrous character, and the cells are found to be more elongated and closer together. The stellate cartilage is met with in the cornea of the eye and in some specimens of enchondroma. Its cells are, as the name implies, star-shaped or multipolar cells, while the matrix is homogeneous in structure and nearly or quite transparent.

The specimen is a carmine staining prepared by Dr. Seiler.

PLATE XII.

TRANSVERSE SECTION OF BONE.

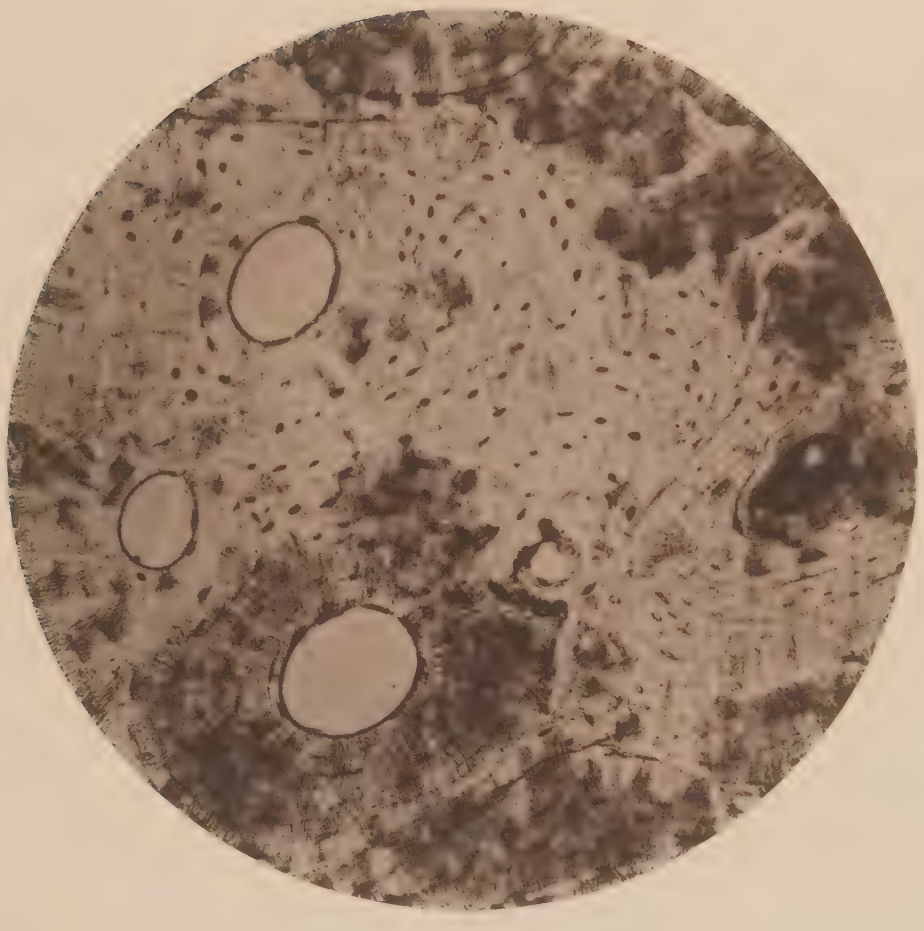
This plate shows the general structure of bone in the dry state. The large oval openings are the Haversian canals, in which the larger vessels find room to penetrate the hard tissue of bone. They are surrounded by concentric layers called lamellæ, in which we find the lacunæ with the fine canaliculi branching off in every direction.

These lacunæ or bone corpuscles are shaped very much like a double convex lens, except that instead of being exactly circular they are elongated in one direction, giving them an oval or elliptical outline; they occur on the outer surface of the Haversian lamellæ, and are so numerous that Walker counted on an average seven hundred and forty to the square millimeter in human bone. They communicate freely with each other by means of a system of delicate, anastomosing, tortuous tubules (the fine canaliculi mentioned above), which may be brought distinctly into view, according to Virchow, by boiling decalcified bone in a solution of caustic soda. In fœtal bones it is not difficult to demonstrate cell structures with well-defined nuclei inside the corpuscles of bone, but some authorities contend that these lacunæ and their anastomosing canaliculi in older bones are simply cavities with gaseous contents made up largely of carbonic acid. This theory accords best with the well-known fact that after macerating a thin section of bone in oil of cloves or turpentine the so-called bone corpuscles seen so distinctly in the plate become almost invisible.

If a longitudinal section be taken, the appearances are very similar to those of a transverse section. The lamellated or concentric arrangement, however, is lost, and the Haversian canals appear like half tubes instead of circular or oval open spaces, and their tubes are seen to branch and communicate (so that each Haversian canal runs only a short distance), but in other respects the structure has much the same appearance as in a transverse section.

The specimen used for this plate is a French preparation injected with carmine and mounted in balsam.

PLATE XII.



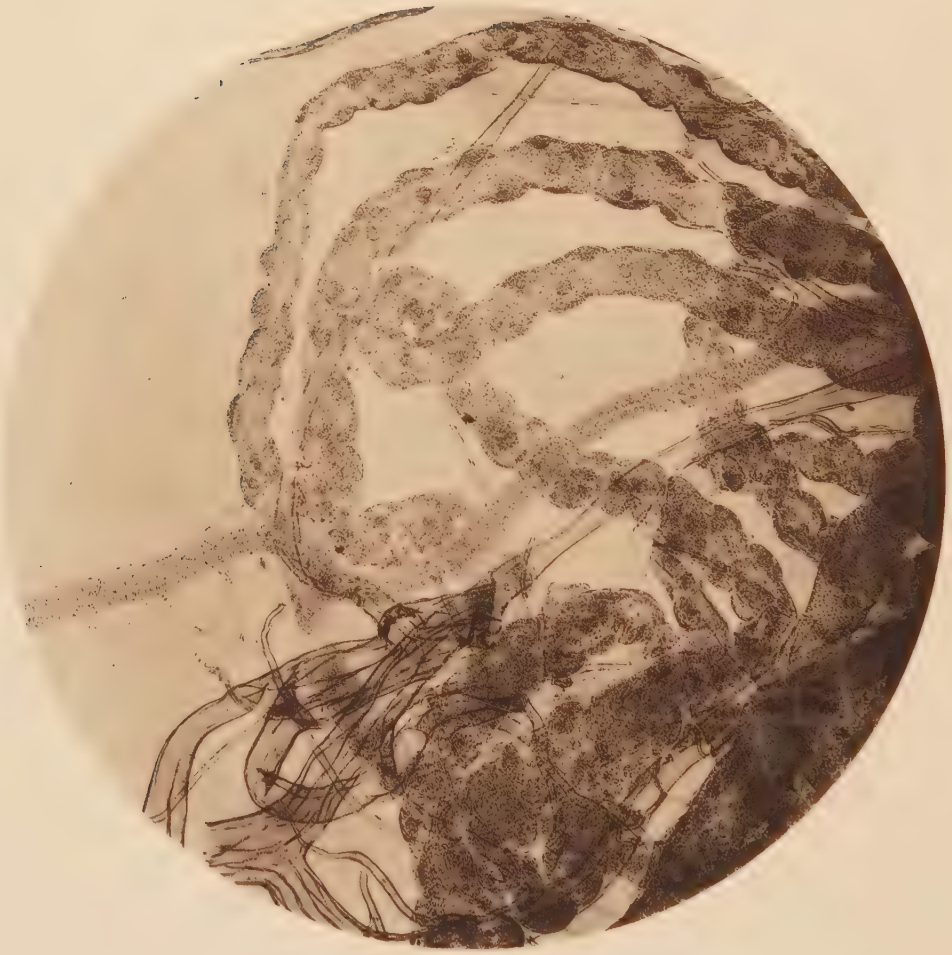
TRANSVERSE SECTION OF DRY BONE.

80 Diameters.

FRENCH PREPARATION.

PHOT., C. SEILER, M.D.

PLATE XIII.



HEPATIC CELLS.

From Liver of a Fly.

80 Diameters.

PREPARED BY J. G. HUNT, M.D.

PHOT., C. SEILER, M.D.

PLATE XIII.

HEPATIC CELLS FROM LIVER OF A FLY.

In histological investigations and studies we frequently have to examine a structure in the lower animals in order to understand clearly the same tissue in the more complex arrangement of its constituent parts that we find in the higher classes of the animal kingdom. One of these tissues is the liver, which, in man and other higher animals, presents to the histologist a structure so complex that it is exceedingly difficult, even under high powers of the microscope, to make out the different minute component parts, and to study them satisfactorily. In insects, on the other hand, this glandular organ, besides exhibiting all the parts on a very much larger scale, is exceedingly simple in the arrangement of the constituent elements.

In examining the plate the liver cells may be seen joined together in long rows, without any perceptible division between the individual cells, which exhibit each its nucleus and nucleolus, in many places. The granular appearance of these chains of cells is due to a deposit of coloring-matter in the formed material of the cell itself. The duct, or tube, which is seen winding its way among the liver cells, is a salivary tubule whose epithelial lining may be distinctly recognized. Its columnar epithelial cells, although very small, show their nuclei as little dark spots, while the division line between the cells is visible only in a few places. In the lower part of the plate we see a large air-tube, which sends its branches all over the field of the microscope. The power of magnification is too low to bring out the spiral fibres which in the fly are very delicate, and whose office is to keep the tubes open for the free circulation of air.

A specimen of this sort can very easily be made by opening the thoracic cavity of the common house-fly under water; the intestines will then float to the surface of the water, whence they can be transferred to the staining solution, and may be mounted in glycerine.

In this way the specimen from which this plate is made was prepared by Dr. Hunt.

PLATE XIV.

LEUKÆMIA OF THE LIVER.

In Leukæmia we have an alteration of the numerical proportion of the white to the red corpuscles in the blood, frequently combined with a tumefaction of the lymphatic organs. It is usually associated with other pathological conditions of those organs which must be regarded as the birthplaces of the white corpuscles, viz., the spleen and mesenteric glands. In health the average proportion of the white to the red disks is as 1 to 450, but in this form of disease we often find a proportion of 1 to 10, and even in some cases the red and the white corpuscles are equal in number.

If under such conditions a hyperæmia occurs in a glandular organ, migration of the leucocytes takes place from the blood-vessels into the neighboring tissue with unusual readiness. The leucocytes extravasate in such numbers through the walls of the vessels as to cause a tumefaction, which, to the naked eye, exhibits a milk-white color. The microscopic appearance of such a tumor in the liver is seen in the plate.

On the right hand side of the plate the course of a small vessel, somewhat out of focus, may be seen, from which the white blood-corpuscles have emanated. In the centre of the plate they are seen in large numbers occupying the place of liver cells which have disintegrated and disappeared, leaving nothing behind but the network of connective tissue with which they were normally surrounded.

"In this infiltration the liver cells remain passive; crowded off from the vessels, the source of their life and functional capacity, they perish atrophic, and we can often perceive, even with the naked eye, a brown speckling of the liver substance, which is to be traced back to heaps of pigment granules, the last remains of liver cells." (*Rindfleisch.*)

In the lower part of the plate some cells in their normal condition may be observed; but here also, as in the case of the liver cells of the fly (Plate XIII), the cells seem to run into each other without any distinct dividing line, except where they are separated by vessels and ducts.

The specimen is a carmine staining mounted in balsam, and prepared by Dr. Seiler.

PLATE XIV.

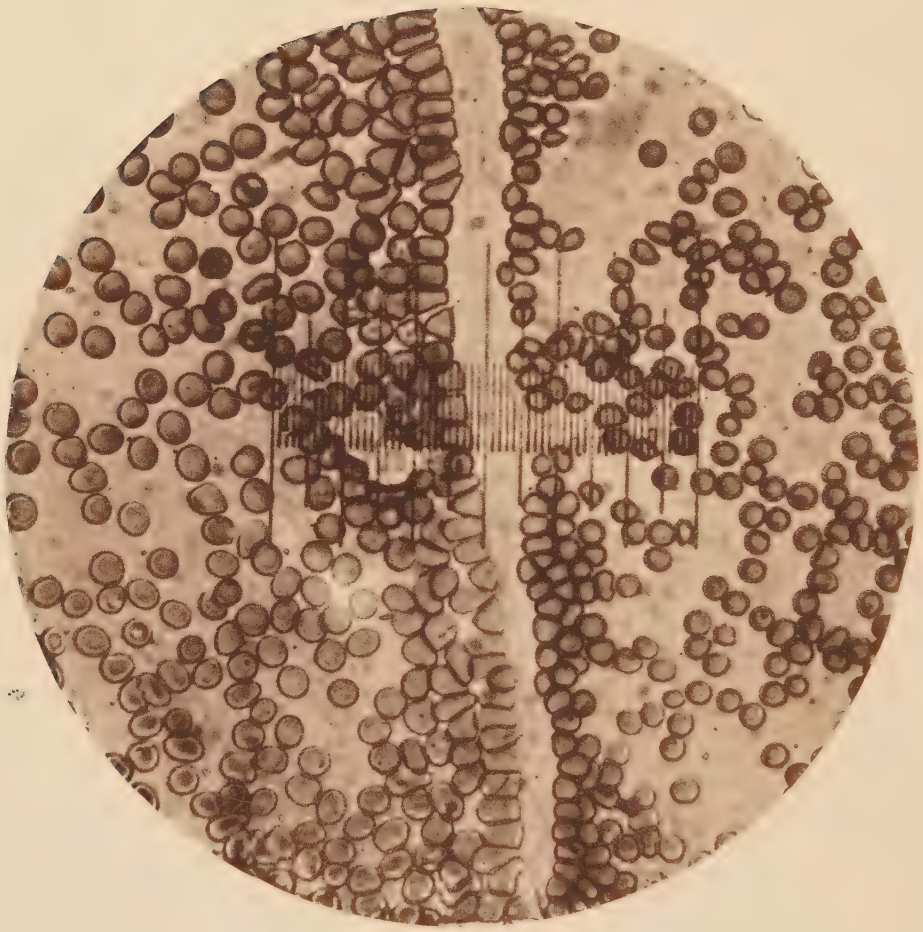
LEUKÆMIA OF THE LIVER.

220 Diameters.

PREPARED BY C. SEILER, M.D.

PHOT., C. SEILER, M.D.

PLATE XV.



BLOOD CORPUSCLES

Of Man and of the Ox.

650 Diameters.

PREPARED BY J. G. RICHARDSON, M.D.

PHOT., C. SEILER, M.D.

PLATE XV.

BLOOD CORPUSCLES.

This plate is of interest, since it shows the difference in size of the blood disks of man and the ox, seen in close juxtaposition and with a micrometer scale. On the left hand side of the plate we see the disks of human blood, under different foci, indicating their peculiar biconcave shape. Near the centre of the plate we see two white blood corpuscles, which, in the blood of all the higher classes of animals, are very much larger than the red ones. At the edge of the human blood a peculiarity of the blood disks may be observed, namely, their crowding together and consequent distortion. This distortion takes place more frequently in human blood than in the blood of other animals, with the exception of the sturgeon. The blood corpuscles of this fish, as Dr. S. W. Mitchell has pointed out, have the peculiarity, in drying, of collecting in rossette-shaped groups, while their nuclei all move toward the centre of the rosette.

On the right hand side of the plate we find the blood of the ox. The disks are also seen under different foci, indicating a similarity of the shape of the disks to those of human blood. Their transverse diameter, however, is considerably smaller, thus affording a means of distinguishing them from the human. The disks of most mammals are smaller than those of man, but similar in shape; so that we regard any differential diagnosis from those that are nearly alike in size to human blood as unreliable.

Dr. J. J. Woodward has lately published an excellent method for measuring the transverse diameter of blood disks, viz., by spreading them upon a stage micrometer and then photographing both the lines of the scale and the disks with a very high power. In this way he is able to measure them more accurately and with less expenditure of time than could be done with an eye-piece micrometer. The micrometer scale in the plate has no definite value, but is merely placed there to facilitate comparative measurements.

Specimens of this kind were first prepared by Dr. Richardson, early in 1875, for the special purpose of illustrating to jurors in murder trials, that not only do the corpuscles of human blood exhibit an obvious and unquestionable characteristic in their superiority of average size over the corpuscles of ox's, pig's, or sheep's blood, but also that, as a rule (to which there are very few exceptions), the largest corpuscles found in an ox, pig, or sheep, are *smaller* than the smallest unaltered corpuscles of human blood. This method of demonstration has since been imitated by sundry observers.

PLATE XVI.

FAT CELLS.

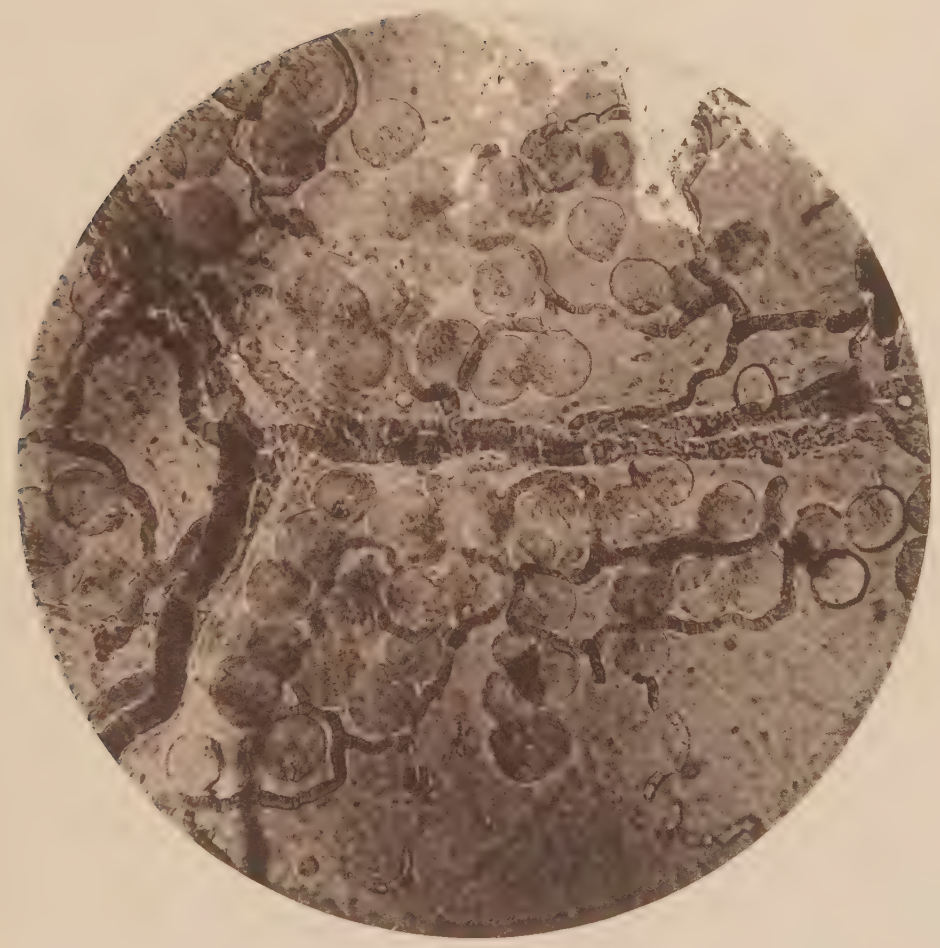
The beginner in microscopic investigations, being unfamiliar with the size and shape of different structures, is often puzzled to distinguish one from another, so that he will frequently mistake an oil globule for an air bubble, or *vice versa ;* and even blood disks, under high powers, especially where the lens used is not possessed of good definition, have been mistaken for fat cells ; but, although these latter are similar in some points, yet the fat cells are by so much the larger (as may be seen by comparing the two plates, Nos. XV and XVI), that an error seems hardly possible. Under some conditions, however, it is difficult to distinguish fat cells and oil globules from other similar structures, and the gradual formation of crystals of the fatty acids within the cell may be our only available proof that it contains an oleaginous material.

The specimen from which the plate under consideration is taken, is a fragment of the mesentery of a cat with the vessel injected ; the plate shows a large number of fat cells of different sizes, many containing acicular crystals. It also shows in its lower part, although obscurely, because it was unfortunately impossible to get this part entirely into focus, the exceedingly delicate connective tissue of which the membrane consists. Within the fat cells themselves the fine needles of the fat crystals may be observed originating in one point and spreading fanlike toward the centre of the globule. The vessels are seen to ramify between the cells, and in the inferior portion, close to the main trunk of the artery, a delicate nerve fibre may be traced for some distance.

The fat cells being spherical, it was found to be almost impossible to obtain a photograph of the specimen in which refraction lines did not obliterate every detail, and the plate exhibits these lines in some of the cells, but not, however, in a very marked degree.

The specimen was prepared by Dr. Hunt, and mounted in glycerine. If a specimen containing fat, as for instance a section of a fatty tumor or of a tissue which has undergone fatty degeneration, is mounted in balsam, the previous treatment with absolute alcohol will abstract all the fat and leave nothing but a network of cell walls behind. Such a specimen presents a very different appearance from one mounted in glycerine or other aqueous solution which shows the fat cells with their crystals in their normal magnitude and rotundity.

PLATE XVI.



FAT CELLS.

From Mesentery of a Cat.

200 Diameters.

PREPARED BY J. G. HUNT, M.D.

PHOT., C. SEILER, M.D.

PLATE XVII.

KIDNEY OF A MOUSE,

Injected.

30 Diameters.

French Preparation.

Phot., C. Seiler, M.D.

PLATE XVII.

KIDNEY OF MOUSE INJECTED.

This plate exhibits the general shape and outline of the kidney as we observe it in most of the higher animals and in man, while, on the other hand, the organ differs very materially in structure and in the arrangement of its elements among the reptiles. In that class of animals the tubules, instead of being convoluted and occupying the smallest possible space, as is the case in the kidney of the higher order, are straightened out, and are few in number in comparison with the amount of space the organ occupies.

In this plate the Malpighian corpuscles, with their different arteries, are distinctly visible throughout the cortical portion of the kidney as black spots with dark lines running to them. This cortical substance forms about three-fourths of the gland. It occupies the surface of the kidney, forming a layer about two lines in thickness, where it covers the pyramids and sends numerous prolongations inwards. The space between the Malpighian corpuscles is seen to be occupied by the urinary tubules, which, however, are not visible in this plate, except as a granular substance, the photograph having been made with a low-power lens in order to obtain a view of the whole specimen. From this cortical portion the tubes and vessels are seen converging toward the central part, the pelvis, from whence the ureter carries the excreted urine into the bladder. The commencement of the ureter can be seen on the right side of the plate.

The specimen from which this negative was made is a longitudinal section through the whole organ, with the exception of a small portion at the upper end, which is wanting.

It is a French preparation, and was injected with a transparent carmine injection, but was not stained.

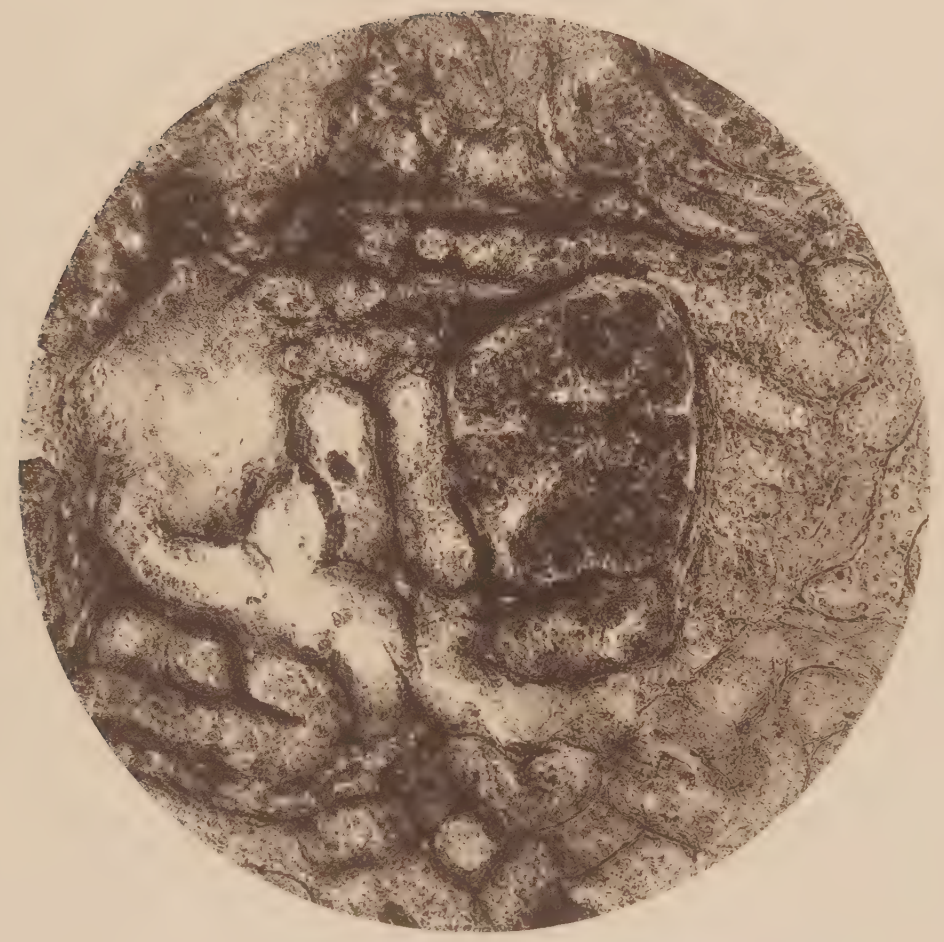
PLATE XVIII.

CHRONIC NEPHRITIS.

This plate exhibits the appearances under the microscope in an inflamed kidney. The walls of the tubules are slightly thickened and the lining epithelial cells are loosened from their basement membrane, while the calibre of the tubules themselves is filled with albuminoid substance, which shows itself in the form of *tube casts* in the urine of patients afflicted with this disease. The epithelial cells themselves contain minute dark granules in the protoplasm, which cause an increase of size in the cells, and which is designated by pathologists as *cloudy swelling.* These granules gradually become so numerous as to obscure the nuclei and even the walls of the cells entirely, and the tubules on cross-section appear to be filled with a granular mass. This in the present case has in some parts of the specimen degenerated into fat, which fatty degeneration has attacked also the connective tissue. Thus, on the left side of the plate, two large openings are seen, in which the fat has been dissolved by the alcohol used in preparing the specimen. In these open spaces a few cells have still remained intact, while in the upper space the coagulated albuminoid material can be recognized. Near the centre of the plate a Malpighian corpuscle is exhibited, which, having been pressed upon by the increase of volume of the tubules, has lost its roundness and has assumed its present almost square shape. The capsule of the corpuscle is also seen to be slightly thickened. On the right side of the plate a few tubules are seen in an almost normal condition, while in some others a loosening of the epithelial cells may be observed, no thickening of the walls of the tubes having occurred as yet.

The specimen is a carmine staining mounted in Damar balsam, and was prepared by Dr. Seiler.

PLATE XVIII.



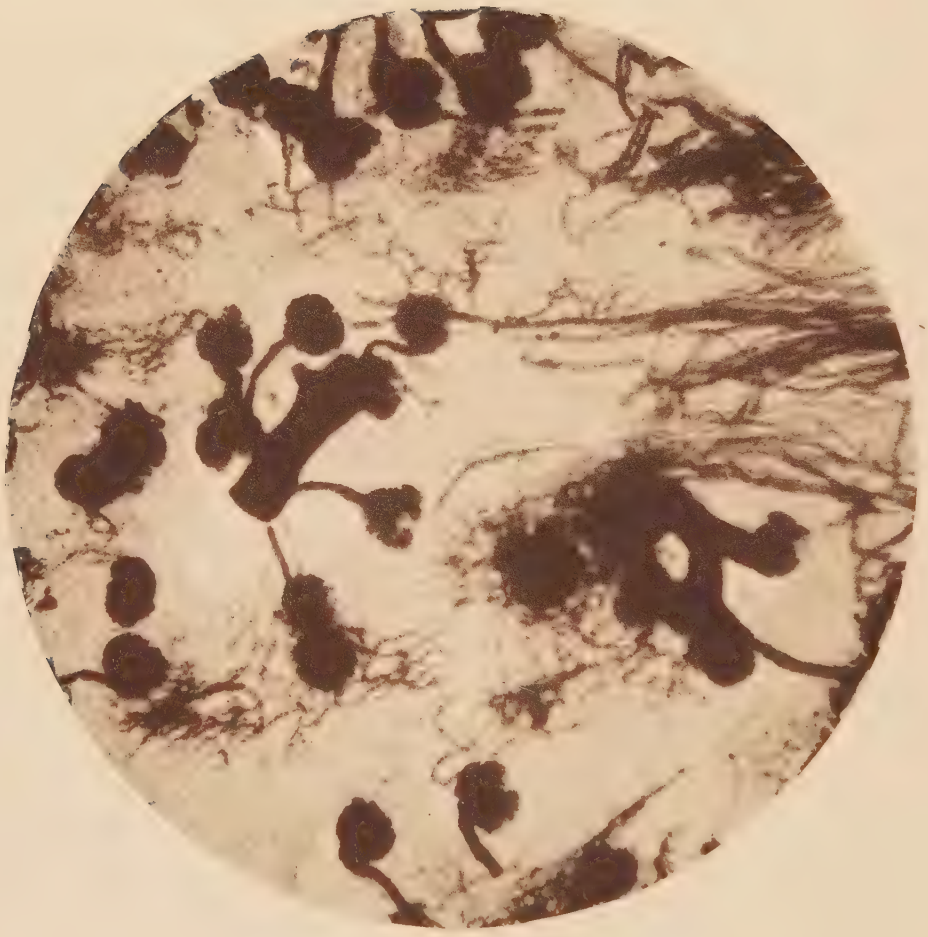
CHRONIC NEPHRITIS.

220 Diameters.

PREPARED BY DR. C. SEILER.

PHOT., C. SEILER, M.D.

PLATE XIX.



MALPIGHIAN TUFTS,

Injected.

80 Diameters.

SPECIMEN FROM QUEEN & CO.

PHOT., C. SEILER, M.D.

PLATE XIX.

MALPIGHIAN BODIES INJECTED.

This plate shows the arterial system of the cortical portion of the kidney, which, having been filled with a transparent injecting material, is rendered visible in the preparation. The round dark bodies which are seen in the plate are the Malpighian corpuscles, found only in the cortical portion of the organ. They consist of a vascular tuft or coil enclosed in a thin membranous capsule, the dilated commencement of a uriniferous tubule. This tuft is composed of the ramifications of the afferent artery, which, after entering the capsule, divides into many branches, which ultimately terminate in a finer set of capillary vessels. As seen in the plate, the afferent vessel is generally a very short branch of the main trunk of the artery. The efferent vessel or vein pierces the capsule near the entrance of the artery, and forms a close venous plexus with the efferent vessels from other Malpighian bodies around the adjacent tubules. This efferent vessel is not seen in the plate, the arteries alone having been injected in the specimen.

The capsule containing the coil of vessels called the Malpighian body is, however, not always found at the commencement of a tubule, but is frequently observed to be situated at one side of the tube. When thus placed, they are called "lateral bodies." The membrane composing the capsule is thicker than that of the tubule, and is lined with a thick layer of epithelial cells. According to Bowman, the surface of the vascular tuft lies free and uncovered in the interior of its capsules; but Gerlach asserts that it is covered with a thick layer of nucleated cells similar to those lining the inner surface of the capsule itself.

The specimen from which the plate was made was injected with gelatine and carmine, mounted in balsam, and was obtained from Messrs. Queen & Co.

PLATE XX.

CRYSTALS OF UREA.

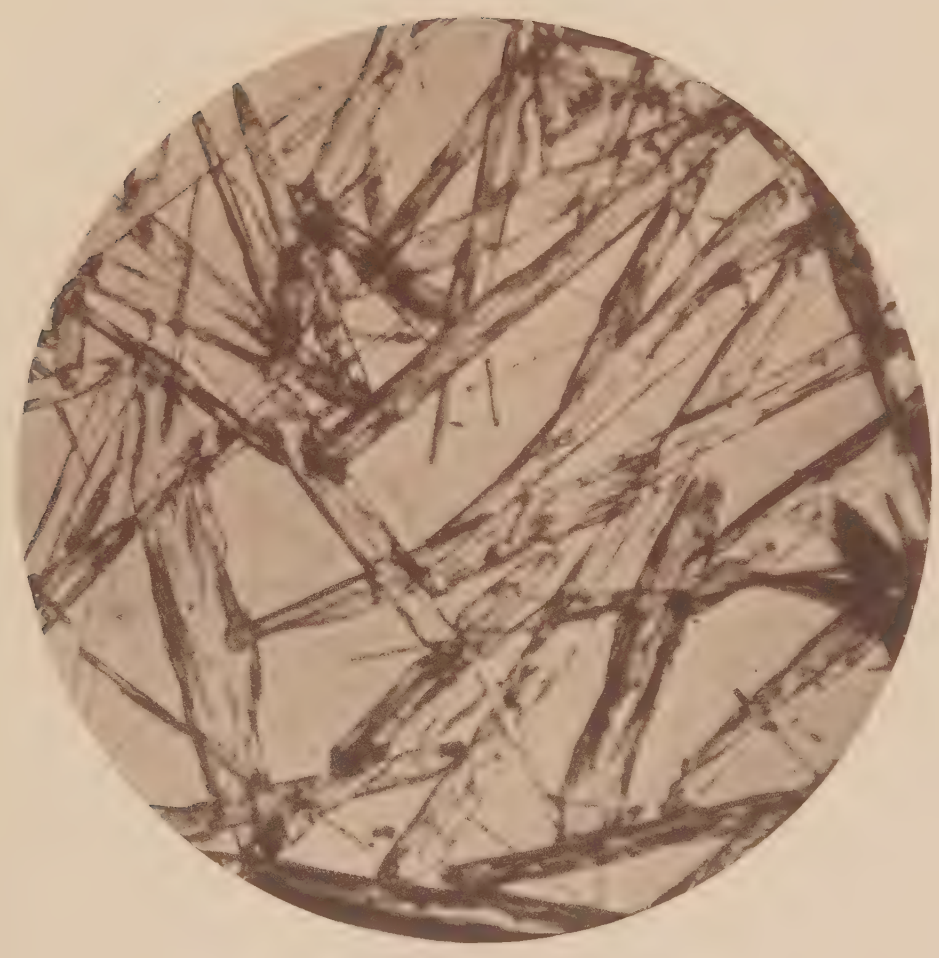
"Urea is a neutral, crystallizable, nitrogenous substance, readily soluble in water, and easily decomposed by various external influences, such as heat, for instance, which converts it into carbonate of ammonia. It is found in urine in the proportion of thirty parts per thousand. The blood, however, is the source from which this substance is supplied to the urine, and it exists in small quantities in the circulating fluid, for the reason that it is constantly filtered out as it were by the kidneys. The original source of urea is, however, as yet unknown, for it is not found in any of the solid tissues in a state of health." (Dalton's *Physiology*.)

The mode of obtaining urea in a crystallized form is rather complicated, and is as follows: Fresh urine is evaporated in a water-bath until it has a syrupy consistency. It is then mixed with an equal volume of nitric acid, which latter combines with the urea to form nitrate of urea. This salt rapidly crystallizes, and can be separated from the other ingredients by filtering. The crystals thus obtained are then dissolved in water and decomposed by carbonate of lead, thus forming nitrate of lead, which remains in solution, carbonic acid and urea. The latter is then dissolved out by alcohol and evaporated to dryness, when the crystals of pure urea are obtained.

The crystals of urea are, as is seen in the plate, long, thin plates, with a tendency to split up into smaller fragments. Occasionally needle-shaped crystals with blunt points are found; these are also exhibited in the figure. The crystals are perfectly colorless, and therefore are very difficult subjects for photography, as very little contrast can be obtained in the negative, thus giving a flat print.

The specimen was obtained from Messrs. Queen & Co., and was mounted in balsam.

PLATE XX.



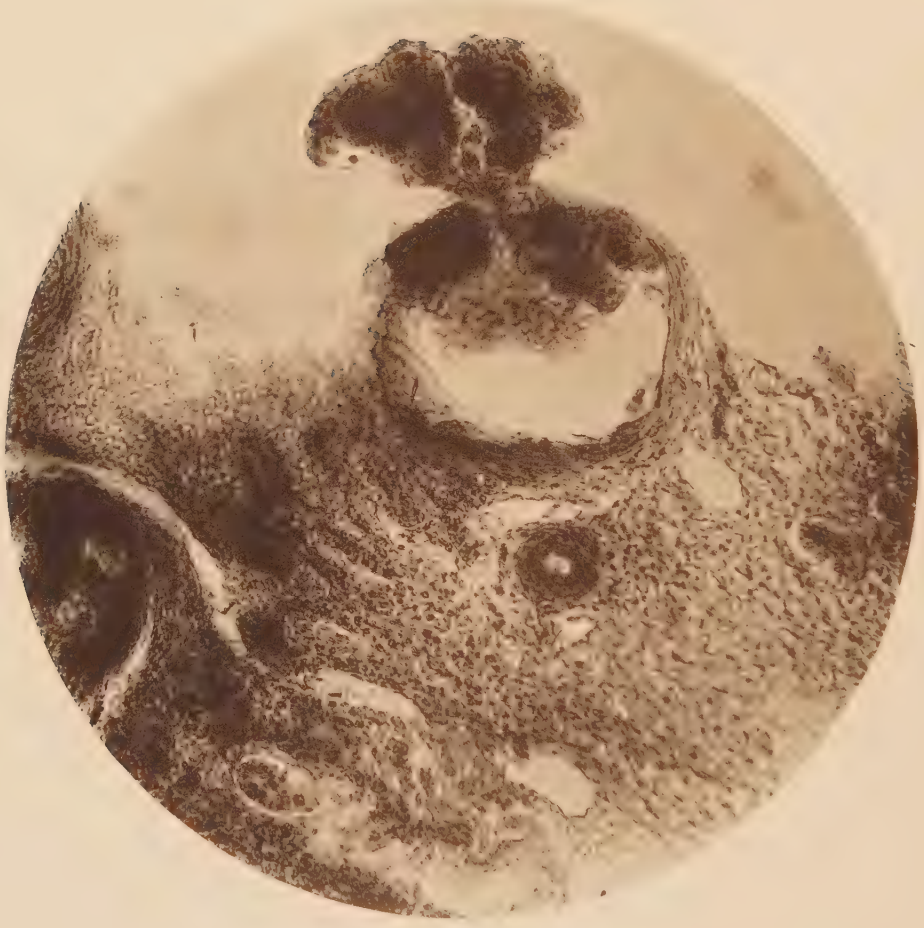
CRYSTALS OF UREA.

120 Diameters.

Specimen from Queen & Co.

Phot., C. Seiler, M.D.

PLATE XXI.



AMYLOID INFILTRATION OF THE KIDNEY.

180 Diameters.

PREPARED BY J. G. RICHARDSON, M.D.

PHOT., C. SEILER, M.D.

PLATE XXI.

AMYLOID INFILTRATION,

WITH CIRRHOTIC THICKENING OF THE MALPIGHIAN CAPSULES.

The term *amyloid infiltration* was applied by Virchow to a peculiar condition of the kidneys, in which a reaction with iodine and sulphuric acid is occasionally seen, resembling that which starch gives with the same reagents. The color produced by iodine alone in a substance containing starch is, however, very different from that seen in an amyloid kidney under the influence of the same reagent, and therefore some writers use the term *albuminoid*, instead of amyloid, infiltration.

This infiltration of albuminous material is, however, not at first observed in the tubules themselves, but in the surrounding connective tissue, where it forms depots of transparent glassy masses, which are not affected by any staining fluid except iodine.

The part of greatest interest in this plate, however, is the enormous increase of the connective tissue forming the capsules of the Malpighian tufts. One of these tufts is seen partly removed from its envelope, thus affording a good view of the capsule, which appears more than three times as thick as it is in the normal condition. This hypertrophy of the connective tissue has not manifested itself in any other portions of the specimen. The contraction of the cirrhosed Malpighian capsule, such as here depicted, plays a very important, but we believe purely mechanical, rôle in the progress and fatal termination of gouty disease of the kidneys. In the lower part of the plate a few of the convoluted tubules can be recognized, with their epithelial cells within them, while in other parts of the plate the cells alone are visible without any apparent order in their distribution. This was caused by the obliteration of the connective element of the tubules by the infiltration of the albuminous material.

The specimen from which this plate was taken is a carmine staining prepared by Dr. Richardson

PLATE XXII.

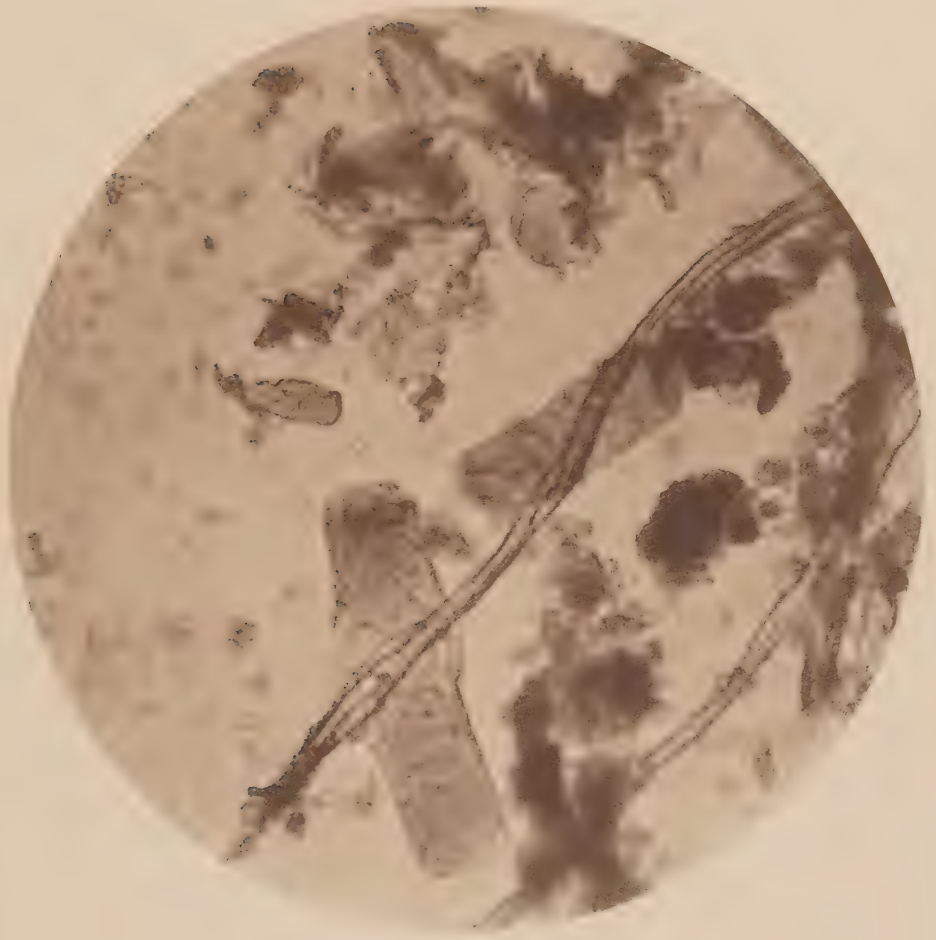
HYALINE TUBE-CASTS OF ADVANCED BRIGHT'S DISEASE.

The diagnosis of *morbus Brightii* in its earliest stages is occasionally beset with difficulties which completely baffle the tyro in microscopy, but in cases when such tube-casts as are represented in this plate make their appearance in the urine a recognition of the malady proves comparatively easy. These casts, as is well known, are formed in the lumina of the uriniferous tubules, and of course vary in size according to that of the cavity in which they are moulded. In a primary stage of the chronic form of this affection, small cylinders not averaging more than 1-1,600th of an inch in diameter are frequently met with, and indicate that the uriniferous tubules have been narrowed below their normal calibre, probably by the swelling of the epithelial cells which constitute their lining. In later stages of the disease larger and very large casts (such as we here see), averaging 1-200th of an inch across, are found, in consequence of the desquamation of the epithelial cells, which necessarily trebles or quadruples the calibre of the tubules, now represented only by their basement membrane. Large tube-casts may, however, be formed in the wider straight portions of the uriniferous tubules, near their outlets at the apices of the pyramids, and hence it is only when a urinary sediment is made up chiefly of such gigantic casts that we must conclude our patient's condition is a dangerous one, corresponding to the evidence of advanced structural change in the kidney.

The appearance of the tube-cast in the lower part of the field, as though spread out by the pressure of the flax fibre, which crosses it diagonally, is very interesting as proving the soft, almost gelatinous, nature of the material whereof the cast is composed. The flax fibres were mounted with the casts in order to prevent the latter from being crushed by the weight of the thin covering of glass.

The photograph is from a specimen prepared by Dr. Richardson, and mounted in solution of acetate of potash.

PLATE XXII.



HYALINE CASTS

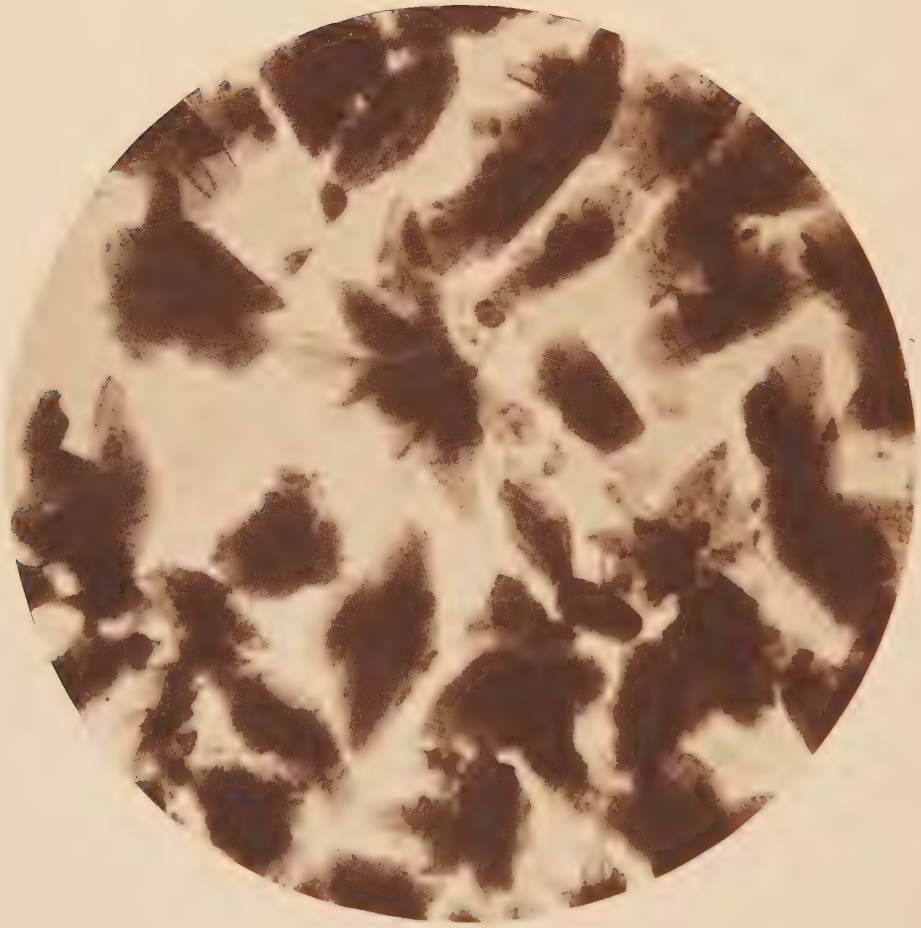
Of Advanced Bright's Disease.

180 Diameters.

PREPARED BY J. G. RICHARDSON, M.D.

PHOT., C. SEILER, M.D.

PLATE XXIII.



URIC ACID.

130 Diameters.

PHOT. C. SEILER, M.D.

PLATE XXIII.

CRYSTALS OF URIC ACID.

The presence of uric—or, as it was formerly called, lithic—acid in the urine soon after it is voided indicates the disease denominated *lithiuria*, and is believed to be one of the common expressions of the widely-disseminated arthritic diathesis.

Near the centre of this plate is an excellent example of the so-called "cayenne-pepper grain," a mass made up of eight or ten angular crystals of uric acid, apparently "arranged with a most perfect adaptation of means to ends," so as to secure, in whatever position it is placed, a maximum of mechanical irritation to the delicate mucous membranes lining the genito-urinary tract. In fact, few persons, whether physicians or patients, after inspecting the cruelly jagged contour of this group of spicula, can fail to appreciate the instant importance of prompt medical treatment directed toward the faulty condition of the assimilation processes, for the purpose of avoiding, if possible, such agonies as attend the passage of aggregations of these crystals in the form of nephritic calculi along the ureter, or the tortures which ensue from their larger accumulations in the shape of stone in the bladder.

Another and smaller "cayenne-pepper grain" may be seen below and to the right of that just referred to, whilst between them is visible one of the common but curious "barrel-shaped" crystals of uric acid which are possibly the results of crystalline force, modified by, and yet modifying, some so-called "vital" power of the organic matter which enters into their composition.

The specimen from which the photograph was taken is mounted in balsam, and was obtained from Messrs. J. W. Queen & Co., Philadelphia.

PLATE XXIV.

CRYSTALS OF TRIPLE PHOSPHATE.

This salt of tribasic phosphoric acid, in every atom of which an equivalent of ammonia, of magnesia and of water is required to satisfy the polygamous acid, is also known by the name of the ammoniaco-magnesian phosphate. It usually crystallizes in the form of triangular prisms with obliquely truncated ends, and constitutes one of the most common as well as the most beautiful varieties of urinary deposits.

The lower figure on the left of the plate is an illustration of one of the more rarely observed modifications of its crystallization—namely, that resulting from the action of ammonia and produced by the partial solution of the crystals after they have been perfectly developed. The ammoniacal reaction generally makes its appearance after a few days, in consequence of the decomposition, or rather re-arrangement, of the elements of urea into carbonate of ammonia. Curiously enough, this solvent action of the alkaline salt is exerted primarily upon the edges and sides of the phosphatic crystals, between the angles instead of upon the angles themselves, in such a way as to produce rudely cruciform masses similar to that here depicted.

To the right and a little above the middle of the plate may be seen, a little out of focus, a small prism—about three-fourths of an inch long—of triple phosphate, which displays the usual truncated extremities observed when such crystals are viewed laterally.

The remarkable clearness and transparency of the ammoniaco-magnesian phosphate render its perfect crystals almost impossible to photograph distinctly, but the importance of the subject renders it worth while to include this plate.

The specimen from which this plate was made is a balsam preparation obtained from Messrs. J. W. Queen & Co., Philadelphia.

PLATE XXIV.

TRIPLE PHOSPHATE.

130 Diameters.

PHOT. C. SEILER, M.D.

PLATE XXV.

STRIPED MUSCULAR FIBRE.

180 Diameters.

PHOT., C. SEILER, M.D.

PLATE XXV.

STRIPED MUSCULAR FIBRE.

Two kinds of muscular tissue are found in the animal body—viz., that of voluntary or animal life, and that of involuntary or organic life.

The plate under consideration exhibits the peculiarities of the voluntary muscle as it appears under the miscroscope, the fibres or bundles of fibres showing distinct transverse lines or striæ. These stripes form one of the most important diagnostic signs for distinguishing between voluntary and involuntary muscular tissue, there being only one exception—viz., the muscle of the heart, which is not under the influence of the will, but exhibits, nevertheless, distinct striæ.

Besides the transverse lines, longitudinal ones may be seen running along the fibre bundles in the plate. These latter lines indicate the joining of the ultimate fibrils into which the fibres may be subdivided, and of which Plate XXVIII. shows an example.

The fibres of muscle are held together by a transparent investing membrane, called the *Sarcolemma*, which is seen in the specimen along the edges of the fibre bundles, especially in the upper left side of the plate. In preparing a specimen of striped muscular fibre care should be taken not to exert an undue pressure upon the object, as otherwise the striæ will all disappear. The fibres, if well stained with either carmine or hæmatoxylon, exhibit along their course distinct nuclei, indicating the position and arrangement of the elongated cells of muscular tissue.

The dark, thick lines running in different directions over the plate indicate the courses of the arteries, whose sharpness in the photograph was sacrificed in order to bring out the striæ more distinctly.

The specimen was injected with carmine, but not stained, and was obtained from Messrs. Queen & Co.

PLATE XXVI.

UNSTRIPED MUSCLE.

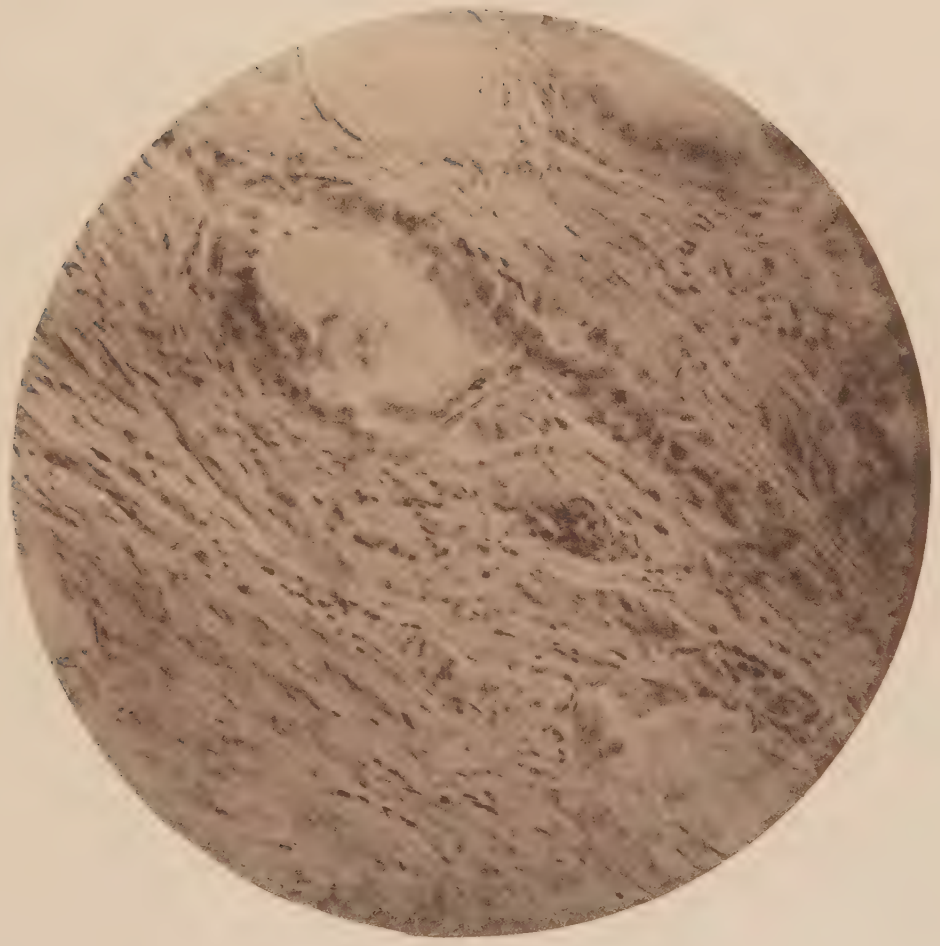
This plate shows the characteristics of organic or involuntary muscle as we find it in the muscular coat of the intestine and stomach, and other parts of the animal economy too numerous to enumerate here.

No distinct fibres or bundles of fibres are visible; but instead of this, a parallel arrangement of elongated, spindle-shaped cells with a distinct nucleus in each may be observed. These cells form flattened bands, interlacing in various directions, and which, when examined under the microscope, without being previously treated with proper reagents appear nearly homogeneous. The nuclei can easily be brought to view, however, by imbibition of a solution of carmine, while a prolonged immersion in nitric acid will isolate the spindle-shaped cells. According to Kölliker, the length of these averages fifteen times their breadth.

In the upper left side of the plate the cells present the appearance of being forced apart by the large round cells, indistinctly seen because slightly out of focus. These cells were originally the lining epithelium of a lacteal, but having become diseased have multiplied to such an extent as to invade the neighboring structures, in this case the organic muscular tissue. They can be traced all over the plate, advancing in a column and forcing the muscular bands apart. The microscopist recognizes in this condition the cancer in its earliest stage, before it has obliterated, through its undue cellular activity, all the healthy tissues within its area of development.

The specimen is from the muscular coat of the human stomach, and is stained with carmine and mounted in balsam at the U. S. Army Medical Museum at Washington, D. C.

PLATE XXVI.



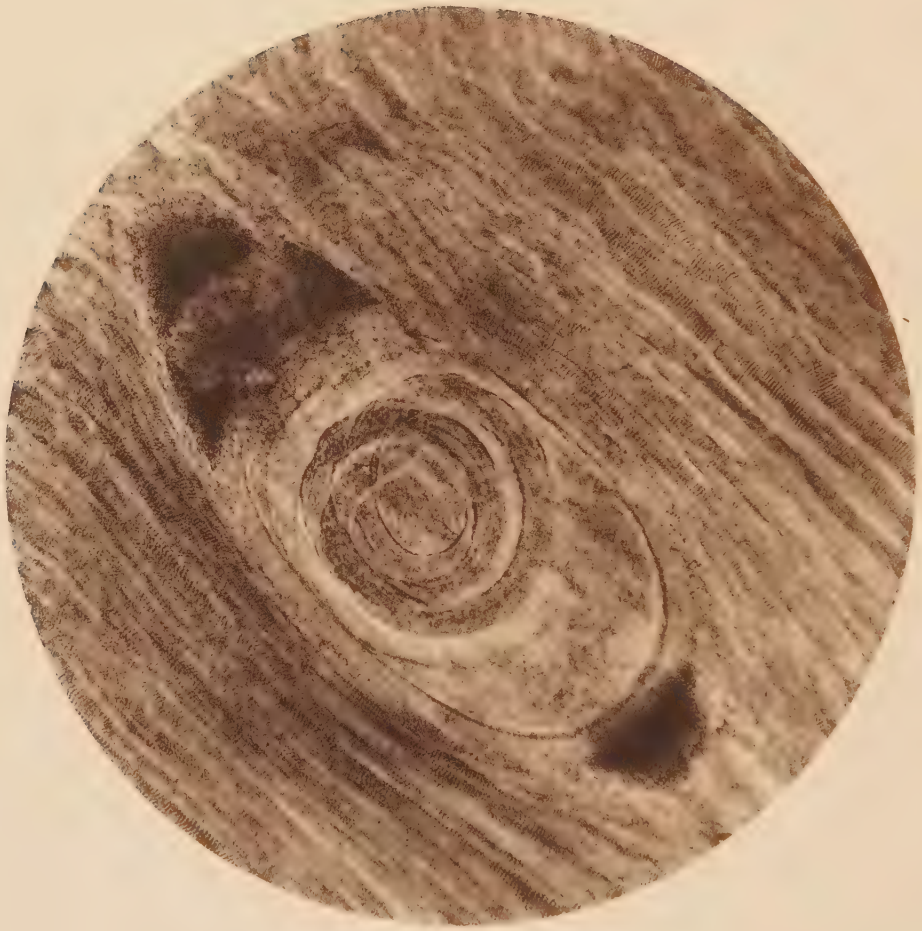
UNSTRIPED MUSCLE.

200 Diameters.

PREPARED AT U. S. A. MED. MUSEUM.

PHOT., C. SEILER, M.D.

PLATE XXVII.



TRICHINA SPIRALIS.

200 Diameters.

PREPARED BY J. G. HUNT, M.D.

PHOT., C. SEILER, M.D.

PLATE XXVII.

TRICHINA SPIRALIS.

Among the parasitic animalculi infesting the interior parts of the animal system, called as a class *Entozoa*, the most interesting, and perhaps most widely known to the general public, is the *Trichina spiralis*, which is found in the muscular tissue of man and of the inferior animals. It is, as seen in the plate, enclosed in an ovoid or spindle-shaped cyst or sack, swollen in the middle and tapering at each extremity, with a rounded cavity in its central portion, in which the worm lies coiled up in spiral form. The worm itself is sexless. At either end of the cyst we find in old cases of *Trichiniasis* a calcareous deposit, which is indicated in the plate by the dark granular masses. The whole of the parasite, with its enveloping cyst, is closely imbedded between the fibres of the muscle, which show in many places the transverse striæ.

It appears difficult to understand how animals without a sexual apparatus should have been produced and deposited in the midst of a solid organ like muscular tissue. The encysted entozoa are, however, nothing but the undeveloped young of parasites, exhibiting different characteristics, and which have produced the eggs after ingestion within the alimentary canal. The eggs are rapidly hatched out, and the parasites work their way, or are carried by the circulation, into the muscle, where they appear as fully-formed trichina, the further development or metamorphosis of which is arrested by the want of proper conditions.

The presence of such an animal, although motionless and unable to change its place, naturally will give rise to unpleasant and often dangerous consequences; and if we take into account the great number frequently met with, often amounting to many millions of individuals, we can understand the enormous fatality which attends Trichiniasis.

The specimen is unstained, and was mounted in balsam by Dr. Hunt.

PLATE XXVIII.

ULTIMATE MUSCULAR FIBRILS.

This plate shows those ultimate fibrils into which the striped muscular fibres can be subdivided, and exhibits their striæ in a very marked degree. Each fibril is cylindriform, somewhat flattened, about $\frac{1}{18000}$th of an inch in thickness, and apparently consists of a single row of particles connected like a string of beads. These particles—called *sarcous elements* by Bowman—are little masses of pellucid substance, having a rectangular outline and appearing dark in the centre. Their appearances would favor the suggestion that the elementary particles are possibly nucleated cells, cohering in the manner described, their line of junction being indicated by the transverse striæ.

Kölliker, however, considers the sarcous elements "as artificial products occasioned by the breaking up of the fibrils at the parts where they are thinner." This view of the case receives, we think, some support from the circumstance, mentioned on page 25, that pressure will obliterate the striæ—that is, compress the broken up particles within the sarcolemma so as to resemble their former unbroken condition. But on the other hand, it is opposed by the fact, which we have often observed, that within the bodies of living and healthy salamanders may be seen muscular fibres exhibiting transverse striæ quite as well marked as those here displayed.

In some parts of the plate individual particles are seen isolated, and in that state resemble the mammalian blood-disks. Near the centre of the plate we see one as a black dot, while on the right side there are two others which have a light centre and a dark margin.

Owing to the extreme transparency of the object—which, however, could not be avoided without destroying the characteristics of the specimen—it is one of the most difficult for photography.

The muscle of insects is chosen for this kind of preparation because the fibrils are more easily separated than in human or mammalian muscle.

The specimen was mounted in glycerine, and prepared by Dr. Hunt.

PLATE XXVIII.

ULTIMATE MUSCULAR FIBRILS,

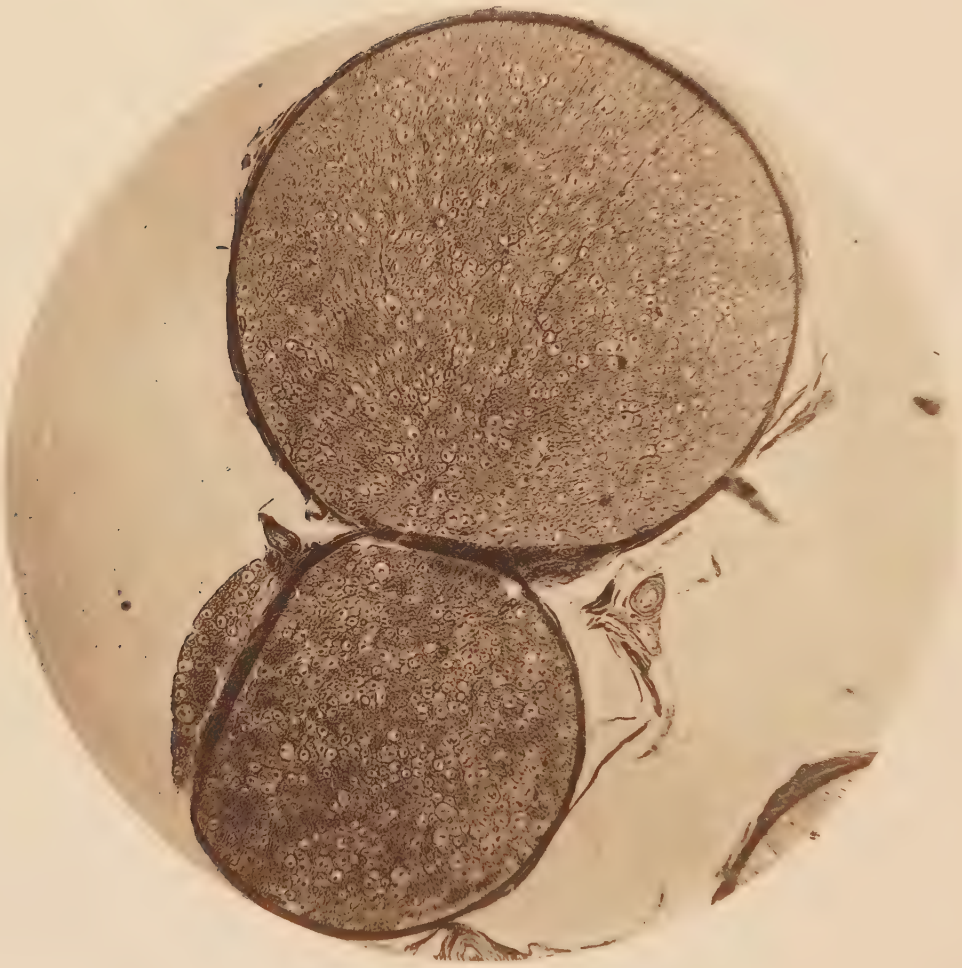
From an Insect.

500 Diameters.

PREPARED BY J. G. HUNT, M.D.

PHOT., C. SEILER, M.D.

PLATE XXIX.



TRANSVERSE SECTION OF NERVE.

180 Diameters.

Prepared by J. G. Hunt, M.D.

Phot., C. Seiler, M.D.

PLATE XXIX.

TRANSVERSE SECTION OF NERVE.

This plate exhibits the structure of nerve fibre with great distinctness and reminds the observer strongly of a section of marine telegraph cable, the common illustration used by teachers in demonstrating the minute anatomy of nerves. Around the nerves is seen a dark, almost structureless band, a section of the enveloping membrane, the *neurilemma*. Within this investing sheath are seen the nervous fibrils separated into bundles by prolongations of the neurilemma. In the larger of these nerve fibrils may be observed a black spot in the centre, representing the axis-cylinder, which is surrounded by a light part, the white substance of Schwann, and the whole surrounded by a dark line, the tubular membrane. In many instances the axis-cylinder is not in the centre of the white substance, but has been displaced to one side showing that this white substance is merely a post-mortem appearance.

Between the two nerve sections shown in the plate, the sections of a small artery with its accompanying vein are seen attached to the neurilemma, by means of a few bundles of connective tissue-fibres.

The investing membrane on the left side of the lower nerve having become detached, has slipped over the section in mounting, thus giving the appearance as if there was a third smaller nerve in the specimen. Through this detached piece of neurilemma, the structure can be distinctly seen, showing how delicate and transparent this membrane is.

The specimen from which this plate is made was prepared by Dr. Hunt, stained with carmine and mounted in balsam.

PLATE XXX.

PACCINIAN BODIES,

FROM MESENTERY OF THE CAT.

These small oval bodies, two of which are seen in the plate surrounded by fat cells, are the terminations of nerve fibres. They are found in the human subject chiefly on the nerves of the fingers and toes, but are most easily demonstrated in the mesentery of the cat.

These terminal corpuscles consist of a number of concentric layers of connective tissue with a cavity in the centre, which is occupied by the axis-cylinder of the nerve. This axis-cylinder terminates in a sort of bulb, which consists of small granules.

Like the striæ of muscular fibre, the concentric fibres of the paccinian corpuscles are entirely obliterated by pressure, while the central cylinder becomes more distinct. In the plate the concentric lines may be seen on either end of the corpuscle, while only the nuclei have remained in the middle. The granular mass surrounding the bodies is an accumulation of fat cells, which on account of their thickness could not be brought into focus with the bodies.

The fact that these terminations of nerve fibres are most frequently found on the nerves of the fingers and toes, led to the belief, that they were intimately connected with the sense of touch; and they are described as tactile organs by many authors, yet the fact that they are found in the mesentery of the cat, where no such sense can possibly exist, disproves this theory. They must, therefore, be regarded as simple protections for the terminations of nerve fibres.

The specimen from which this plate was made was prepared by Dr. Seiler, stained with carmine and mounted in glycerine.

PLATE XXX.

PACCINIAN BODIES,

From Mesentery of Cat.

120 Diameters.

PREPARED BY C. SEILER, M.D.

PHOT., C. SEILER, M.D.

PLATE XXXI.

HYPERTROPHY OF CONNECTIVE TISSUE IN OPTIC NERVE,

With Hæmorrhagic Effusion.

20 Diameters.

PREPARED BY DRS. SHAKESPEARE & NORRIS.

PHOT., C. SEILER, M.D.

PLATE XXXI.

HYPERTROPHY OF CONNECTIVE TISSUE IN THE OPTIC NERVE,

WITH HÆMORRHAGIC EFFUSION.

This plate exhibits one of the pathological conditions of nerve tissue, which is most easily demonstrated by the aid of the microscope—viz., an abnormal increase in the connective tissue element, with a decrease, or crowding out, of the nerve cells. The specimen from which the plate was made is a longitudinal section of the optic nerve, but only very few fibres are seen running parallel to the long axis of the nerve, as in a normal condition they should. Most of the short fibres in the plate have an irregular course, but incline to a transverse direction. These fibres are connective tissue bundles which have become so abundant as to obliterate the nerve fibres and cells almost completely. A few of the latter may be seen here and there in different parts of the plate, as small dark dots.

At the left-hand side of the plate is seen a large dark mass with a light spot near its centre. This is a small artery, surrounded by a considerable effusion of blood disks, forming a tumor of considerable size.

A greater magnification of the specimen would have brought the individual blood-disks to view; but the general outline of the specimen—which is very interesting, especially to those who pay particular attention to diseases of the eye—would have been lost. Above the mass just described is another dark mass, which is nothing but a collection of blood disks that has become detached in mounting the specimen.

The section was stained by Drs. Norris and Shakespeare, by a new double-staining process, published lately in Hayes's Journal, and was mounted in balsam.

PLATE XXXII.

TRANSVERSE SECTION OF SPINAL CORD.

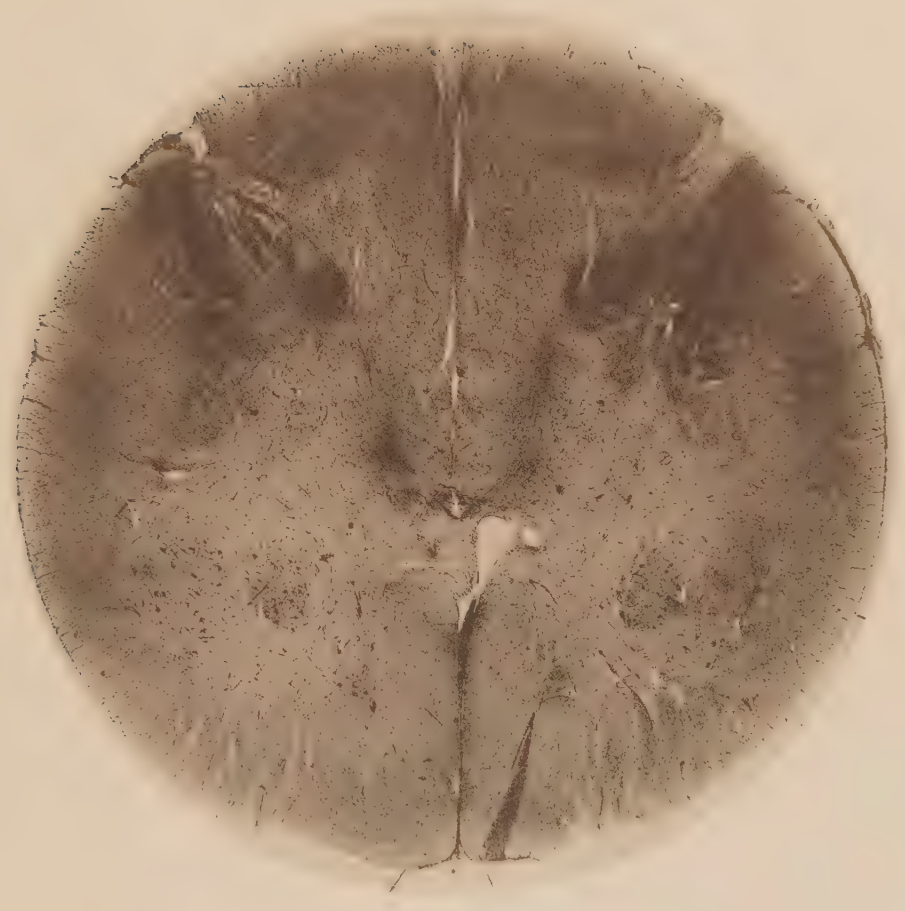
This plate exhibits the well-known characteristic of a cross-section of spinal cord—viz., the gray matter imbedded in and surrounded by the white matter, the reverse from that which is observed in the brain. This gray matter, supposed to be the active part of nervous tissue, contains the peculiar multipolar nerve cells, or ganglia, which may be seen in the lower part of the plate on either side of the anterior median fissure. They are in most cases of a triangular shape, a nerve fibril emanating from every point of the cell. These fibres are collected in bundles and penetrate the white matter at four principal points, thus forming what are called the cornua of the gray matter in the cord. Near the centre, as well as in various parts of the gray matter, small openings may be observed, which indicate the course of the blood-vessels with which this nervous centre is richly supplied. The whole of the cord is divided by two fissures, the anterior and posterior. The former, the one seen in the upper part of the plate, is by far the longer and extends nearly to the central canal. The posterior cornua, in the upper part of the plate, show comparatively few ganglionic cells, but a greater number of nerve fibres, than the anterior cornua, which is distinctly seen in the plate.

At the periphery of the plate may be seen parts of the enveloping membrane, the *pia mater* which sends prolongations into the fissures, as may be distinctly observed in the lower or anterior fissure.

A low power of magnification is used in order to show the whole of the section on the plate and thus to give a good view of the relation of the parts.

The specimen is a French preparation, stained with carmine and mounted in balsam.

PLATE XXXII.



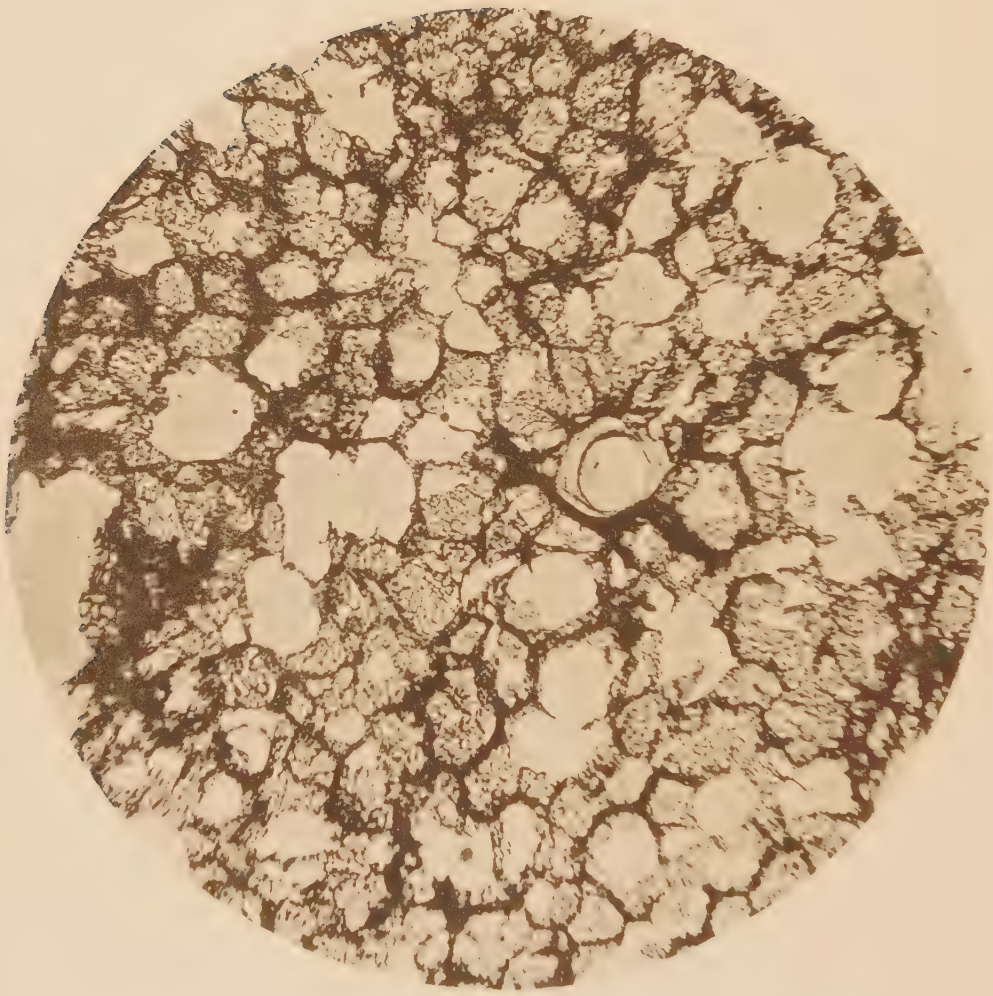
TRANSVERSE SECTION OF SPINAL CORD.

20 Diameters.

French Preparation.

Phot., C. Seiler, M.D.

PLATE XXXIII.



SECTION OF LUNG INJECTED.

120 Diameters.

FRENCH PREPARATION.

PHOT., C. SEILER, M.D.

PLATE XXXIII.

SECTION OF LUNG INJECTED.

One of the most difficult objects for photography, and one which might almost be called a test object for the defining power of objectives, is lung-tissue. Owing to the anatomical arrangement of the air-cells, a section sufficiently thin to bring all parts into the same plane cannot be made, as it would not hold together, and therefore the section must be a thick one in order to give a correct view of the tissue. Owing to this fact only a few air-cells with their capillary network can be brought into focus at the same time, thus leaving the majority indistinct and misty.

In the plate under consideration we see, near the centre, the transverse section of a bronchial tubule surrounded by air-cells which exhibit a delicate net-work of capillary vessels on their surfaces. Around the opening of this tubule, and also in other places of the plate, we see a branch of an artery dividing abruptly into numerous capillaries. This abrupt ending of the branches of vessels is peculiar to the lung-tissue, and we find it nowhere else in the animal economy.

It is in the network of vessels lining or rather dividing one air-cell from its neighbors, that the interchange of gases takes place in respiration.

The object from which the negative was made, being an injection, does not show anything else but the vascular system of the tissue. It is injected with the red carmine and gelatin injecting fluid, and is mounted in balsam.

PLATE XXXIV.

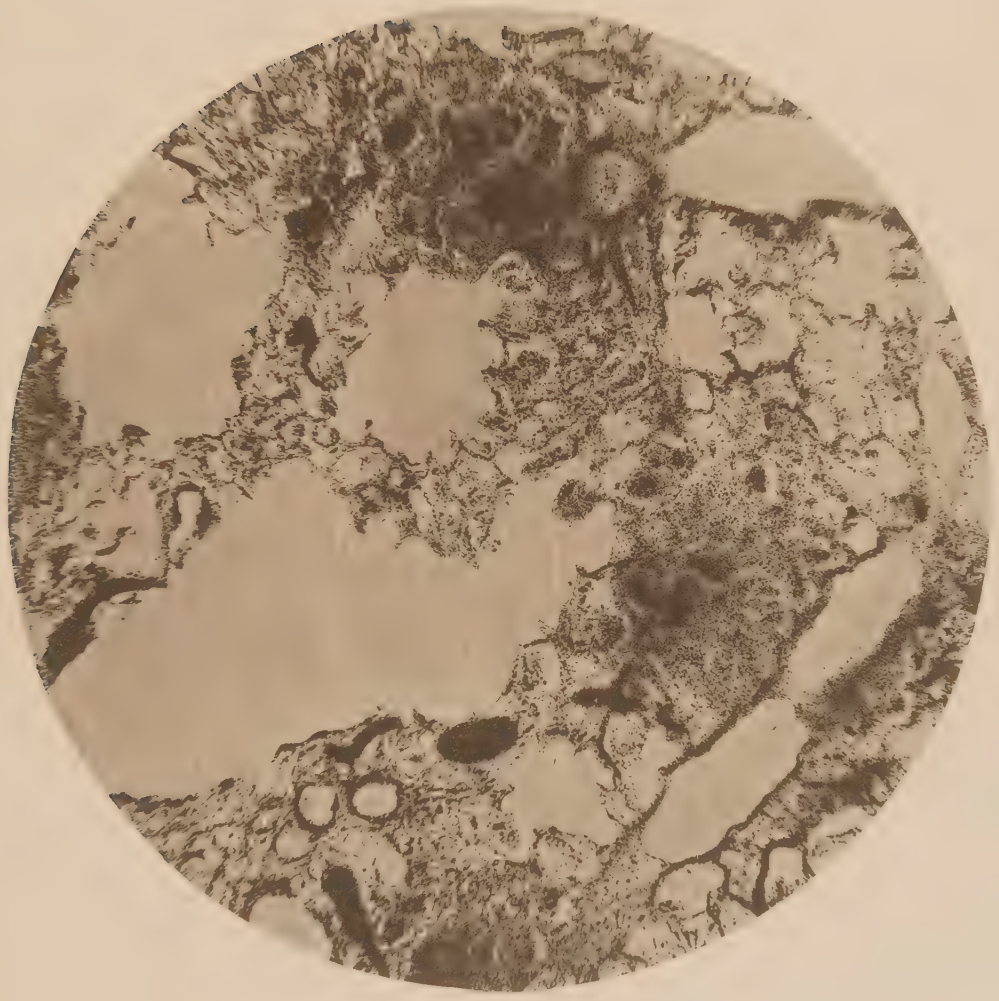
SECTION OF TUBERCULAR LUNG.

In this plate we see a rather thin section of lung-tissue that has been invaded by the new formation of miliary tubercle, which is deposited in large depots near the larger arterial branches, filling up and obliterating the air-cells entirely.

Rindfleisch in his pathological histology says: "The whole lung, including the pleura, is, as a rule, permeated tolerably uniformly with the miliary nodules," of which we see two in the lower part of the plate. "The connective tissue of the lungs is the seat of these disseminated tubercles." In reference to the structure of these tubercles he says: "Upon larger nodules, as a rule, we can demonstrate several centres of development, *i.e.*, points in the interior, around which a part of the tubercle-cells is concentrically grouped, while the others form bands which pass along between the nodules. At the periphery of the nodules the swelling of the alveolar septa, which are inserted here, becomes apparent." This condition of things is illustrated tolerably well in the plate before us. Two large nodules are in full view, while a third one is partly visible on the left side; they all have distinct centres and are connected by bands of newly formed cells, while it will be seen that the alveolar septa are considerably swollen. A low power was used in order to show the general appearance of tubercular lung, in preference to a power which would bring out the histological elements, as the first gives by far the most instructive picture.

The specimen was a carmine staining mounted in balsam, and was prepared by Messrs. Cole and Son, of Liverpool.

PLATE XXXIV.

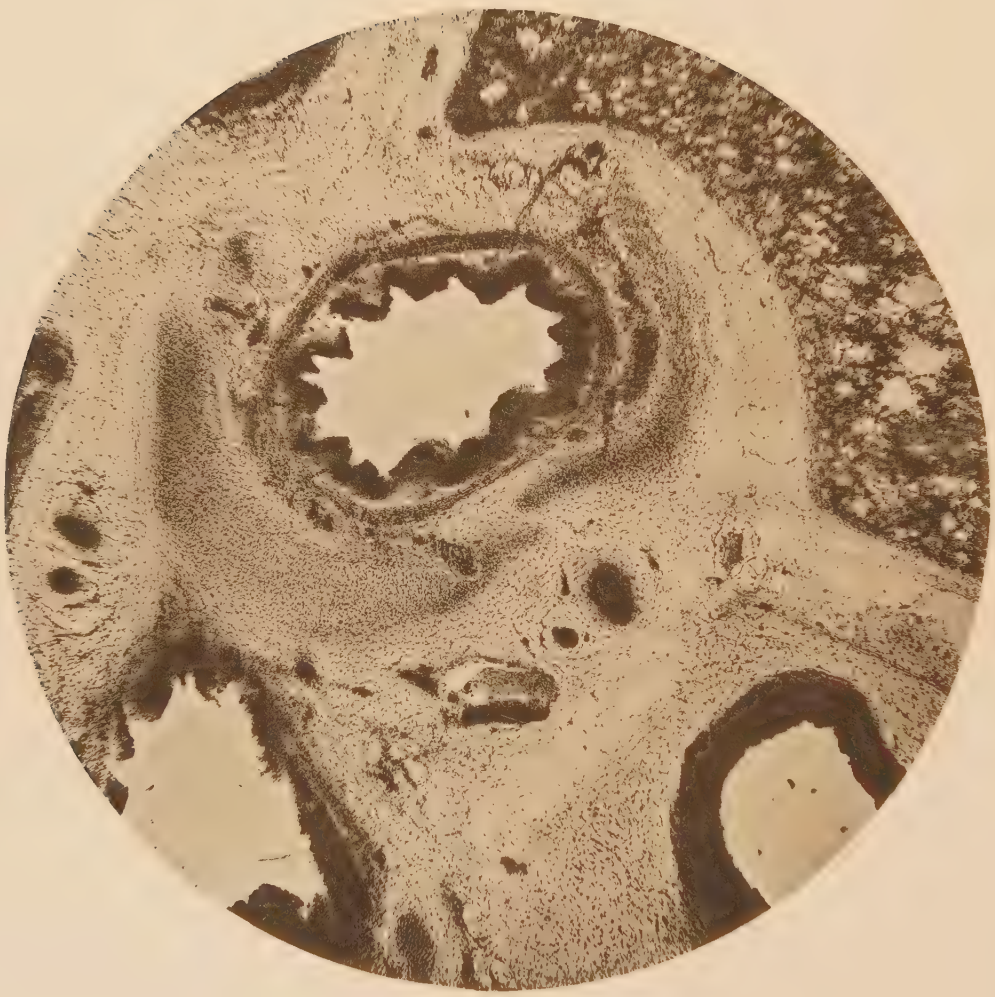


SECTION OF TUBERCULAR LUNG.

100 Diameters.

PHOT., C. SEILER, M.D.

PLATE XXXV.



TRANSVERSE SECTION OF A BRONCHIAL TUBULE.

75 Diameters.

PREPARED BY J. G. HUNT. M.D.

PHOT., C. SEILER, M.D.

PLATE XXXV.

TRANSVERSE SECTION OF A BRONCHIAL TUBULE.

This plate has also been made with a low power lens, in order to give a general view of the relation between the lung-tissue proper, *i. e.*, the air-cells with their capillary system, and the larger bronchial tubes and vessels.

Near the centre of the plate we see a section of one of the bronchial tubes, with its mucous membrane thrown into folds, which project into the calibre of the tube. This mucous membrane is covered with a peculiar epithelium, whose ciliæ, or bristles, are in constant motion, brushing the secreted mucus against the force of gravity upward toward the natural outlet of the air-passages.

Around this mucous membrane we see a band of organic muscular fibres, indicated in the plate by the broad dark band. These muscular fibres by their contraction diminish the calibre of the tubule, and if they do so spasmodically, produce the distressing symptoms of asthma. Above and below the tubule we notice two arches of cartilage, which serve as a support for the tube; the whole is imbedded in a mass of connective tissue, which also serves for a support for the bloodvessels and nerves, cross sections of which several different sizes may be seen in the plate.

In the upper left part of the plate a few air-cells of the lung-tissue proper can be made out, which are however out of focus, owing to the falling off of the lens toward the periphery.

The specimen used for this plate was stained with indigo carmine, and carmine, and was mounted in balsam by Dr. J. G. Hunt.

PLATE XXXVI.

AIR-TUBES OF THE SILK-WORM.

The breathing apparatus of insects is an entirely different one from that of the warm-blooded animals; in the former, a very complex system of tubes, through which the air circulates freely without any propelling power, such as is furnished by the contraction of muscles in the higher animals, is found to take the place of lungs.

These tubes consist of exceedingly delicate membranes, kept patulous by a delicate spiral of a horny substance, very much in the same manner as the flexible gas-tubes are kept from collapsing by a spiral of wire which runs throughout the whole length of the tube.

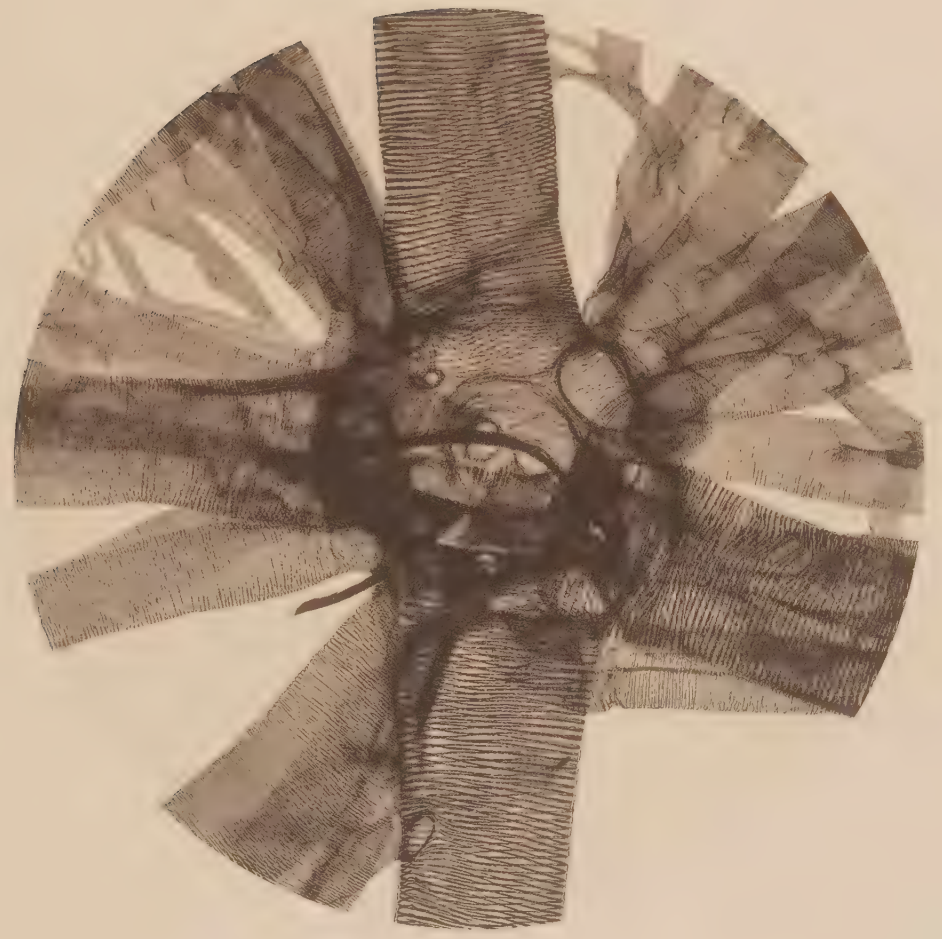
These air-tubes communicate with the outer air by means of openings, which are protected by valves and hairs, to prevent dust from entering. They may be seen in any of the ordinary caterpillars, along the sides of the animal, as they are generally of a different color, thus having the appearance, to the naked eye, of a row of dots.

The plate before us was made from an object showing in the centre one of these openings, with the valves removed, so as to bring the different branches of the tubes into view. The membranous covering can not be seen, as it is too transparent.

It is interesting to note the analogy which exists between these air-tubes and the spiral vessels in plants, which are built on exactly the same principle, but which serve for conducting the sap instead of air.

The specimen was not stained, and is simply mounted in balsam; it was obtained from Messrs. Queen & Co.

PLATE XXXVI.



AIR TUBES OF SILK WORM.

75 Diameters.

PHOT., C. SEILER, M.D.

PLATE XXXVII.

SECTION OF MUCOUS MEMBRANE OF HUMAN STOMACH.

250 Diameters.

PREPARED BY C. SEILER, M. D.

PHOT., C. SEILER, M.D.

PLATE XXXVII.

SECTION OF MUCOUS MEMBRANE OF THE STOMACH.

This plate shows the gastric tubules of the stomach with their columnar epithelium, lining the inner surface of the tubes. These tubes terminate at the under surface of the mucous membrane in blind extremities, and open on the free surface of the mucous membrane in the interspaces between the folds. Among these tubular glandules there are also found in the gastric mucous membrane, closed follicles, resembling the solitary glands of the intestines. These follicles are not very numerous, and are situated in the lower part of the mucous membrane, among the terminations of the tubular glands. A section of the mucous membrane parallel to the surface shows these follicles as patches of granular material, while the enveloping membrane is hardly if at all visible. The section from which this plate was made contains two or three of these follicles, but they are so indistinct as hardly to be recognized, and were therefore not brought into the field.

In many places the epithelial cells on the inner surface of the tubules may be seen in position, especially near their lower extremities, while at the upper extremities the epithelial lining has disappeared, owing to post-mortem digestion of the mucous membrane of the stomach itself. The stomach was obtained from the body of a criminal only two hours after death, but in spite of this short time, the inner surface had been considerably digested by its own gastric juice.

The preparation is a double staining prepared by Dr. C. Seiler.

PLATE XXXVIII.

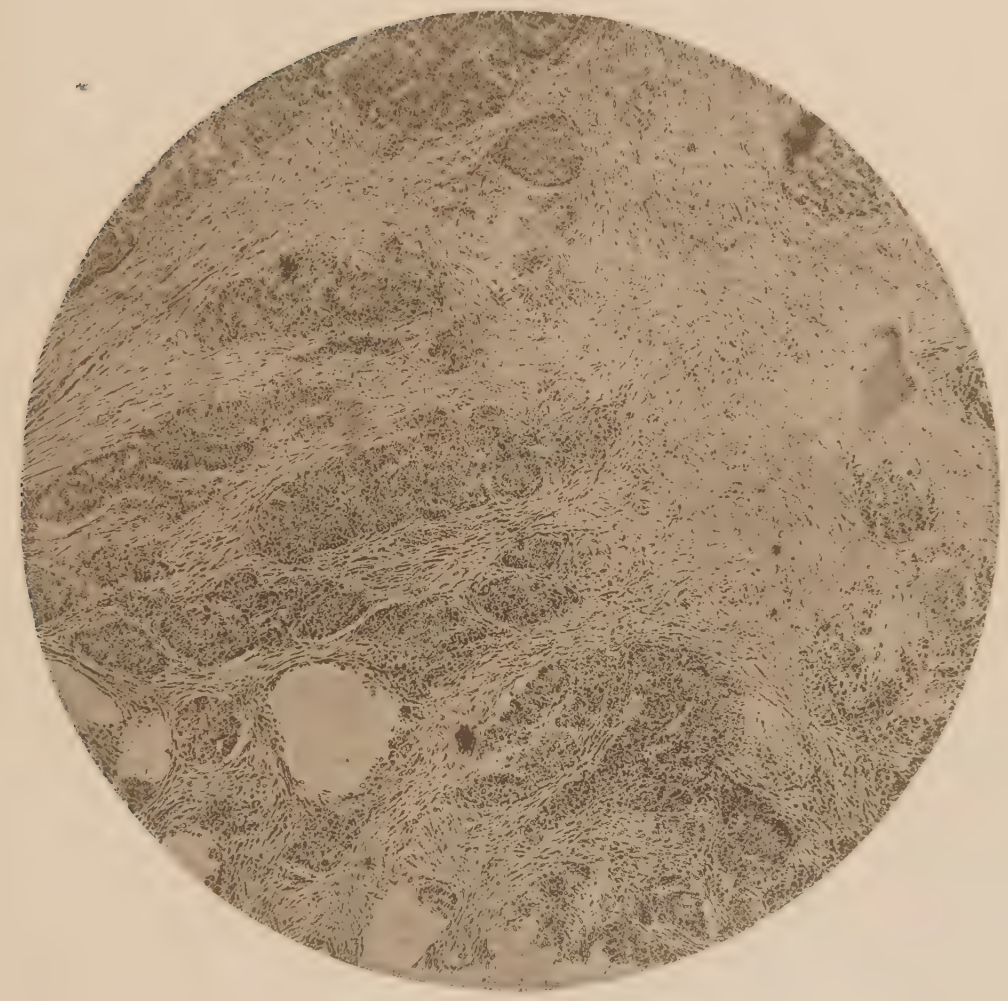
CANCER OF THE STOMACH.

In this plate the infiltration of cancer cells into the tissues of the organ is distinctly seen. The section being obliquely to the surface of the mucous membrane shows the calibers of many of the tubules filled with the carcinomatous cells, while the epithelial lining has entirely disappeared. At the same time the connective tissue elements which divide the tubules from each other, and serve as a support for the capillaries, have been enormously increased, as can be easily seen by comparing this plate with Plate XXXVII, where the connective tissue fibres are hardly visible between the tubules.

Near the upper margin of the plate may be seen one of those solitary closed follicles already alluded to. It is filled with epithelioid cancer cells, and considerably reduced in size by the compression caused by the hypertrophy of the connective tissue elements surrounding it. Near the lower margin, toward the left, we see a large opening containing a few cells adhering to its inner edge. This is the section of a larger blood-vessel whose walls have disintegrated and disappeared, leaving only an opening in the connective tissue.

The specimen from which the plate was made is a carmine staining mounted in balsam, and was prepared by Dr. C. Seiler.

PLATE XXXVIII.



CANCER OF STOMACH.

280 Diameters.

PREPARED BY C. SEILER, M. D.

PHOT., C. SEILER, M.D.

PLATE XXXIX.

TRANSVERSE SECTION OF STOMACH OF FROG.

20 Diameters.

PREPARED BY C. SEILER, M. D.

PHOT., C. SEILER, M.D.

PLATE XXXIX.

TRANSVERSE SECTION OF THE STOMACH OF THE FROG.

The stomach of the ordinary frog is a most interesting microscopical object, as it contains all the elements which we find in the human alimentery canal on a much larger scale. The plate was made with a low power, so as to give the observer a general view of the relation of the different parts to each other.

Around the outside of the section we see a narrow band, which is a section of the serous membrane on the outside of the organ, and which is most distinctly seen on the right side of the plate. Then we see a broad band of organic muscular fibres, of which there is in the frog only one layer. On the inside of this we find the connective tissue containing the larger blood-vessels, indicated in the plate by large dark spots. The most striking feature of the plate, however, is the mucous membrane, thrown into large irregular folds, and containing the gastric tubules. The connective tissue projects into these folds, and is lined at the base of the mucous membrane proper by another band of muscular fibres, called the muscle of Bruke. This band of organic muscular fibres is said to produce an erection of the gastric tubules when they are irritated by the presence of food, or other substances foreign to the organ.

The specimen is stained with carmine and mounted in balsam, and was prepared by Dr. C. Seiler.

PLATE XL.

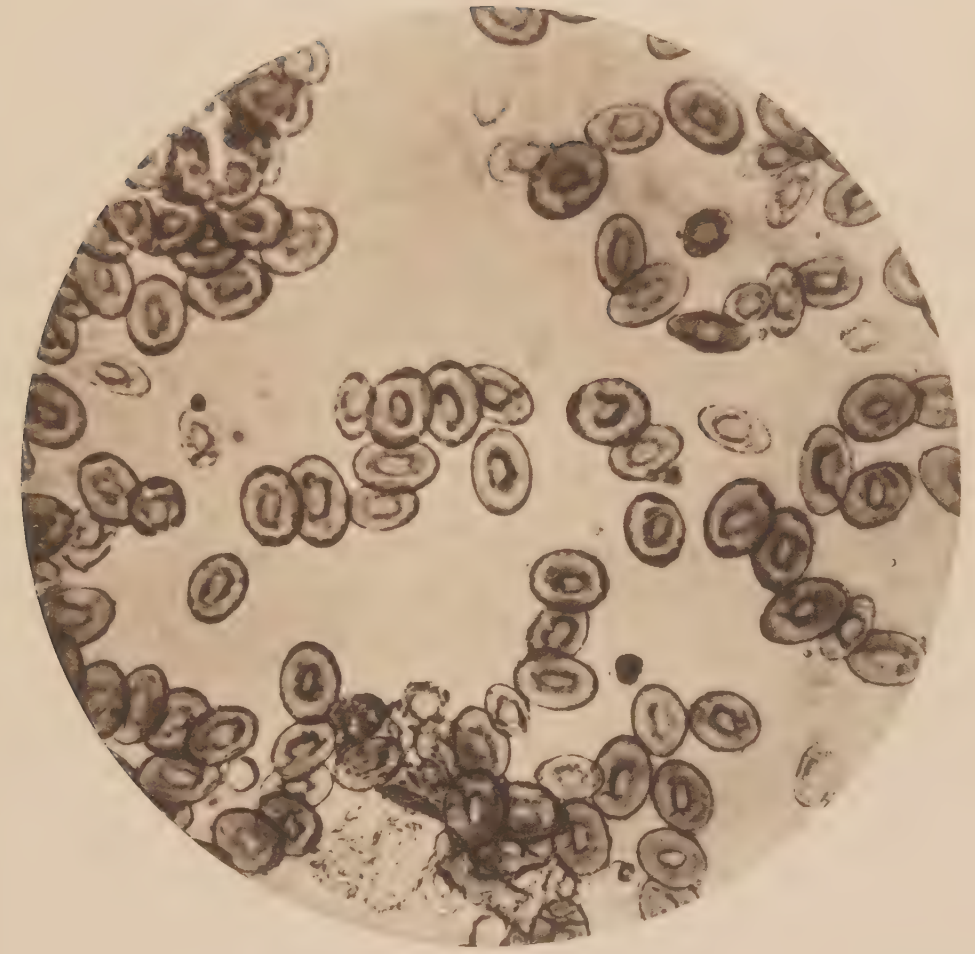
BLOOD OF FROG.

Under certain circumstances it becomes important to distinguish the blood of different animals one from the other. This may be done in two ways, viz.: by the size of the disks, and by their form. In all mammalia the blood-corpuscles are round, and are without a nucleus, except in the camel tribe, in the members of which we find oval blood disks, but also without a nucleus. In birds, fishes, and amphibious animals on the other hand, the blood disks are oval or elliptical, and have an elongated nucleus.

The plate under consideration exhibits such blood disks as we find in the amphibious animals, among which the blood of the *Amphiuma tridatis* contains the largest corpuscles known. In the frog the disks are oval as may be seen in the plate, and have an oval nucleus. Near the upper part, toward the right hand side of the plate, one of the disks is seen edgewise, showing the leticular shape of the corpuscle. In the frog's blood, the white blood corpuscles are smaller than the red, while in mammalian blood the reverse is seen.

The specimen was mounted dry, and was obtained from Messrs. Queen & Co.

PLATE XL.



BLOOD OF FROG.

500 Diameters.

PHOT., C. SEILER, M.D.

PLATE XLI.

SECTION OF HUMAN VOCAL CORD.

30 Diameters.

PARED BY C. SEILER, M.D.

PHOT., C. SEILER, M.D.

PLATE XLI.

SECTION OF HUMAN VOCAL CORDS.

This plate gives a general view of the structure of the inferior or true vocal cord, a duplicature of the mucous membrane lining the larynx. The narrow band which is seen to encircle the whole of the section, and which has become detached near the upper margin of the plate, is the epithelial layer of the mucous membrane. The cells composing this layer are different from those covering the mucous membrane of the respiratory tract, inasmuch as they do not carry the filaments called *ciliæ*, which we find on the epithelial cells of air-passages.

Beneath this band we see the mucous membrane proper, connected with the body of the cord by a loose network of connective tissue. In this body the transverse sections of numerous bundles of muscular fibres are seen separated by bands of connective tissues, and indicated in the plate by dark spots varying in size and shape. It will be noticed that the bundles of fibres are not as tightly packed as is generally observed in a transverse section of muscle, but that they are more widely separated from each other than is ordinarily the case. The physiological action, viz., the independent contraction of individual muscular fibre-bundles, of this muscle, makes this arrangement necessary.

In many places the openings of the blood-vessels may be seen in the plate as light spots. A low power has been chosen for this plate, in order to give a general idea of the shape as well as the coarser structure of this organ, which by using a higher power would have been lost.

The specimen is a carmine staining mounted in balsam, and was prepared by Dr. Seiler.

PLATE XLII.

EPITHELIOMA OF LARYNX.

In one of the earlier plates of this volume epithelioma of the lip was shown, in which only the hair-follicles were infected by the invasion of epithelial cells. In this plate, however, the most typical form of this pathological growth is displayed. The concentric arrangement of the cells around a *depot* of cells is very clearly demonstrated, and in its centre the transverse section of a so-called "epithelial cone" is seen.

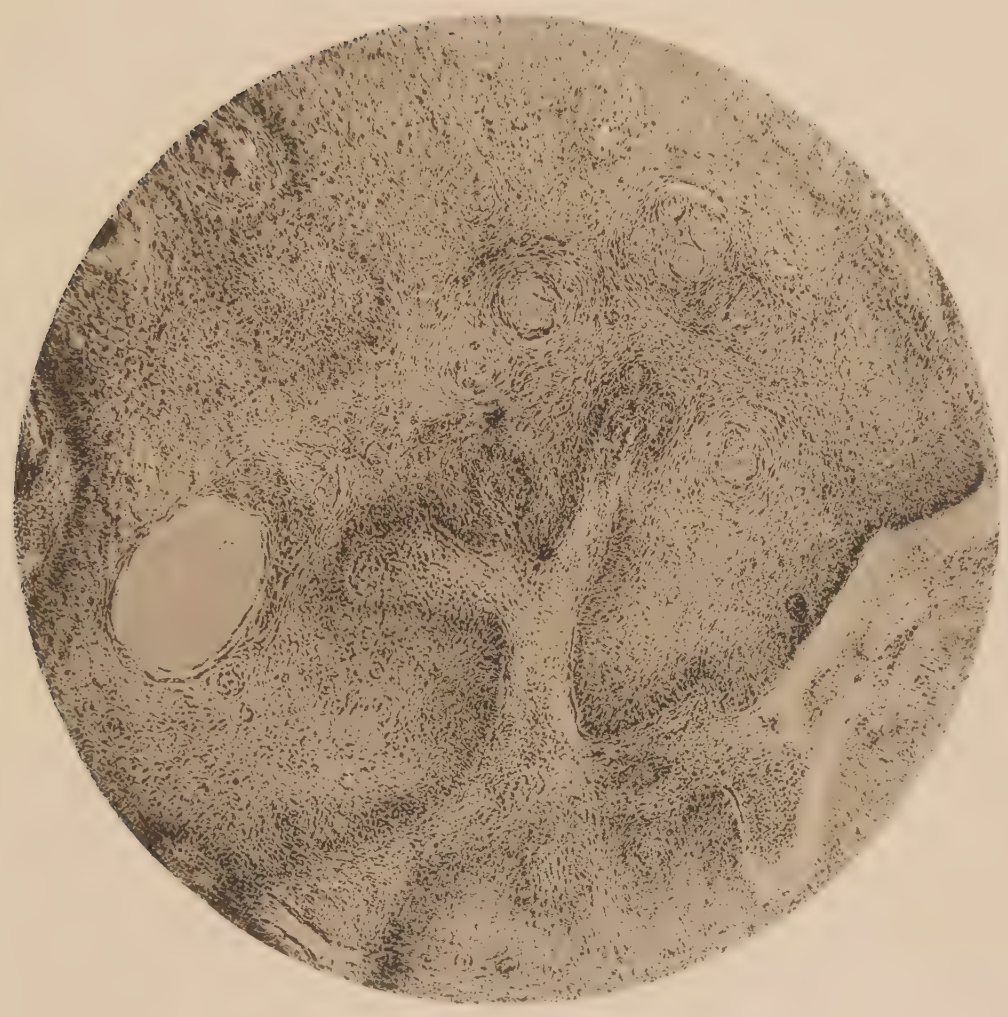
Near the middle of the plate and reaching down toward the lower margin, we see a follicular glandule with three branches projecting into the mass of epithelial cells. This gland and part of the sub-epithelial layer near its mouth, have not as yet been obliterated by the epithelial growth, and it is seen to be partly filled with its natural secretion.

Near the upper margin of the plate, the disintegration of the cancer-cells has already set in, which is indicated by the black granular masses filling the cell-depots, whose general outlines are however still visible. The large oval opening is the section of a vessel whose walls have been partly destroyed in the progress of the carcinoma.

The growth from which the preparation was obtained involved the whole epiglottis, and part of the larynx itself. It was removed from the living subject by means of a curved forceps by Dr. J. Solis Cohen, of Philadelphia.

The piece of the tumor removed, after having been hardened in alcohol, was cut, and the thin section stained with carmine and mounted in balsam, by Dr. Seiler.

PLATE XLII.



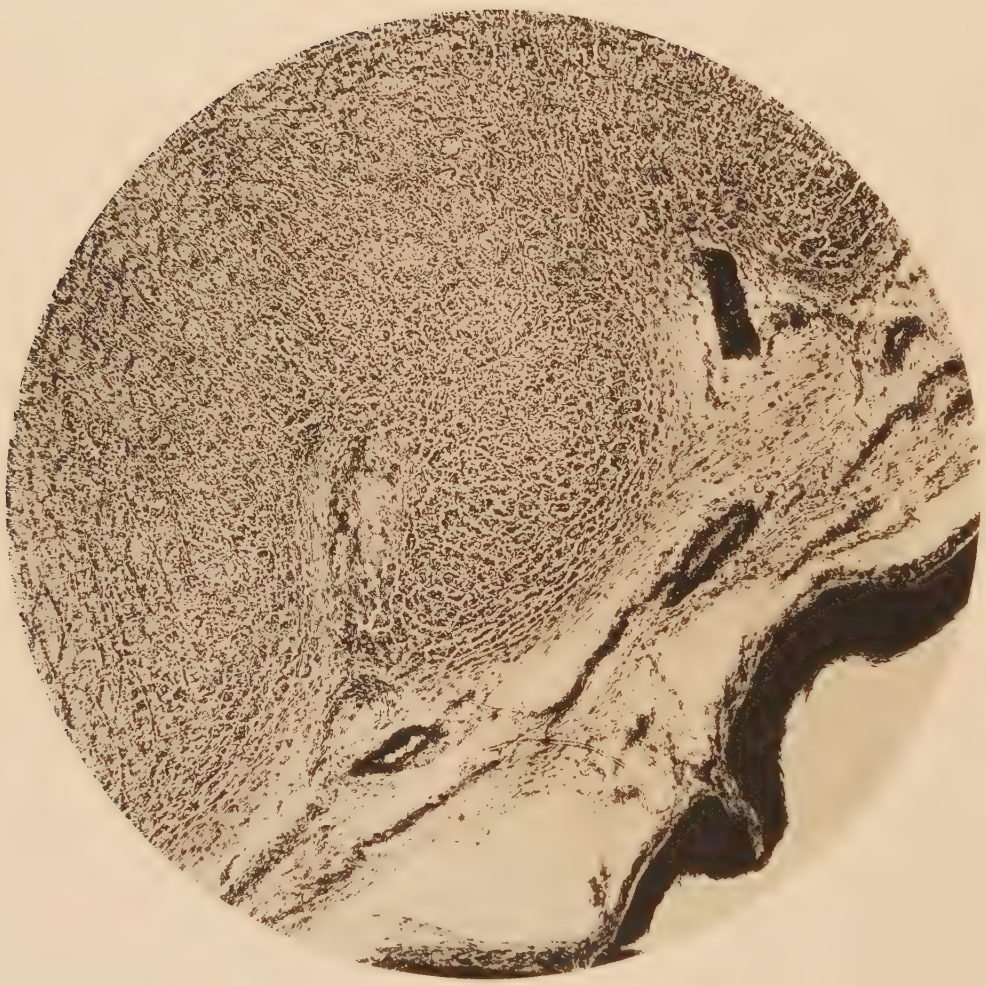
EPITHELIOMA OF LARYNX.

400 Diameters.

PREPARED BY C. SEILER, M.D.

PHOT., C. SEILER, M.D.

PLATE XLIII.



RETICULATED CARTILAGE FROM VOCAL CORD OF DEER.

50 Diameters.

EPARED BY C. SEILER, M.D.

PHOT., C. SEILER, M.D.

PLATE XLIII.

RETICULATED CARTILAGE FROM THE VOCAL CORD OF A DEER.

Beside the elements described and shown in PLATE XLI, we also find in the vocal cords of the higher classes of animals as well as in man, a peculiar kind of cartilage, differing materially from the ordinary hyaline or fibroid cartilage. In the former the cells showing a distinct nucleus are imbedded in a structureless *struma*, while in the latter the matrix shows a fibrous structure. In the reticulated cartilage, however, the cells are in close contact with each other, and are only separated by their cell-walls, thus giving the structure a net-like appearance and making it difficult to distinguish it from a vegetable structure. Only the marginal cells show distinct nuclei, which become more and more indistinct with the age of the cell, until they finally disappear completely in the inner layer of the tissue.

Like other cartilage the reticulated kind derives its blood supply from capillary vessels which project into its substance, but which do not permeate it. The plate under consideration shows, near the middle, one of these capillary loops projecting into the cartilage from the sub-mucous connective tissue. Near the upper right hand margin a larger arterial trunk is seen projecting in like manner.

The same kind of cartilage is also found in the ear of most animals, and is most easily demonstrated in the ear of the mouse, where only the perichondrium has to be removed on both sides in order to bring the structure of the thin plate of cartilage to view.

The specimen was double stained with indigo and carmine and mounted in balsam, and was prepared by Dr. Seiler.

PLATE XLIV.

SECTION OF SCHNEIDERIAN MEMBRANE FROM THE NOSE OF A MOUSE.

This plate shows the ciliated epithelial cells which line the mucous membrane of the whole respiratory tract, with the exception of the true vocal cords. They belong, strictly speaking, to the variety of epithelial cells called columnar epithelium, their shape and size being the same as in this. They bear, however, on their free ends a number of exceedingly delicate filaments, the so-called ciliæ, which in the living subject are constantly moving in one direction—from below upward. This motion of the ciliæ brushes the secretion of the mucous follicles toward the mouth and nose, and we are thus enabled to eject an excess of mucous. All along the margin of the three curved projections in the plate, these ciliated cells may be seen, well defined in many places. In others they are only indistinctly seen owing to the greater thickness of the section.

Near the lower margin of the plate the transverse sections of two mucous follicles are seen, filled with mucous corpuscles. The intervening substance is the connective tissue layer, which connects the mucous membrane to the bone.

The section was made after softening the nasal bone of the mouse in nitric acid and cromic acid, and was then stained with carmine and mounted in balsam, by Dr. Seiler.

In the next issue of this publication there will appear a plate showing the ciliated epithelial cells, isolated, which gives perhaps a better view of their shape and size than when they are in position, as in this plate.

PLATE XLIV.

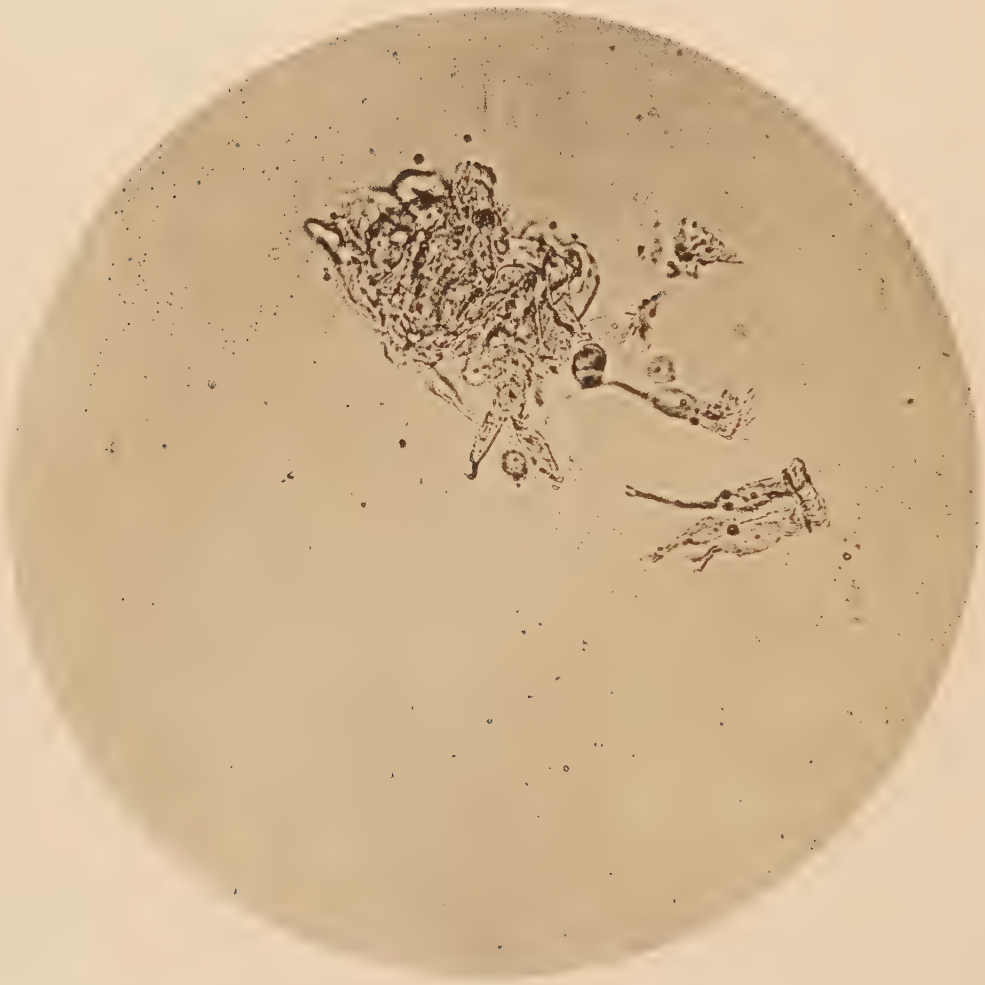
SECTION OF SCHNEIDERIAN MEMBRANE FROM NOSE OF MOUSE.

500 Diameters.

PREPARED BY C. SEILER, M.D.

PHOT., C. SEILER, M.D.

PLATE XLV.



CILIATED EPITHELIAL CELLS.

500 Diameters.

ARED BY DR. J. G. HUNT.

PHOT., C. SEILER, M.D.

PLATE XLV.

CILIATED EPITHELIAL CELLS.

In Plate XLIV, these ciliated epithelial cells were shown in position, lining the mucous membrane of the air-passages. In this plate some of these cells may be seen isolated, thus giving a better idea of their shape than can be obtained when they are aggregated in large masses. It will be noticed that they belong to the columnar variety of epithelial cells, their lower ends, however, being attenuated into a tail-like appendage, while the upper is truncated and is supplied with delicate filaments. The nucleus is very small in comparison with the size of the cell itself, and is usually noticed in the middle of the body of the cell.

In many of the lowest forms of animal life these ciliated cells play an important part, and are essential both for respiration and nutrition. They keep the water in which the animal lives in constant motion, producing a whirlpool into which particles of food are drawn and appropriated by the animal. The constant change of water near the animal supplies the necessary amount of oxygen for respiration.

The larger round bodies seen in the plate, but more or less out of focus, are stray mucous corpuscles which were entangled by the mass of cells and mounted with them.

The specimen from which the plate was made, was obtained by scraping the mucous membrane of the trachea of a small turtle, which scrapings were collected and mounted in glycerine by Dr. J. G. Hunt.

PLATE XLVI.

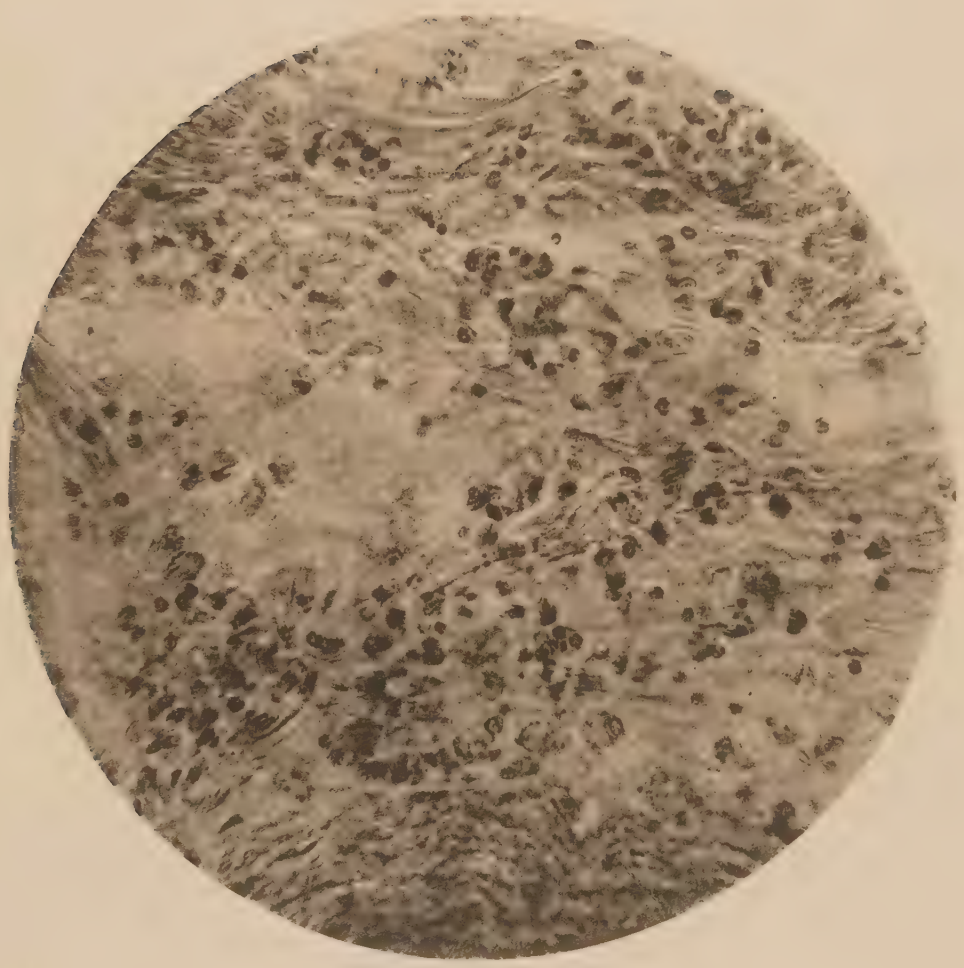
ULCERATION OF INTESTINE IN TYPHOID FEVER.

This plate gives an excellent picture of the changes which take place in a tissue destroyed by ulceration. The view being at first glance rather confused, we will have to examine the different elements separately in order to get a correct idea of the whole. The many bands of fibres which are seen all over the field represent the bundles of connective tissue which is found at the base of the villi of the intestine. Interspersed among these are seen numerous small black corpuscles, differing in size and shape, and forming in many places clusters between the connective tissue fibres, thus resembling somewhat the nests of cells seen in *Scirrhus*. These roundish bodies are the wandering white blood-corpuscles or *leucocytes* which have left the bloodvessels, and have invaded the neighboring tissue. Other corpuscles, of the same size, but lighter in color and containing a nucleus, are seen here and there, and are probably pus-corpuscles, whose nucleus has been made apparent by the acid used in the preparation of the specimen.

The large oval nucleated cells, however, are of peculiar interest; they are the so-called *parenchyma cells*, and are supposed to be the result of the development of the leucocytes. According to this theory these cells form the foundation for the formation of new tissue in place of the disintegrated tissue in which the ulcer has its seat and which it destroyed.

The specimen used for this plate is a thin section of ulcerated intestine, prepared by Messrs. Cole & Son, and is mounted in balsam.

PLATE XLVI.



ULCERATION OF INTESTINE IN TYPHOID FEVER.

350 Diameters.

PREPARED BY MESSRS. COLE & SON

PHOT., C. SEILER,

PLATE XLVII.

SECTION OF LARGE INTESTINE.

80 Diameters.

PARED BY DR. C. SEILER, M.D.

PHOT., C. SEILER, M.D.

PLATE XLVII.

SECTION OF LARGE INTESTINE.

This plate gives a view of the general arrangement of the parts entering into the structure of the intestinal canal. In the upper part the villi with their epithelial covering are seen projecting into the lumen of the tube. The power used in making the plate is, however, not high enough to show the cellular elements distinctly. Immediately below, the base of the villi may be seen as a layer of connective tissue, which in the foregoing plate is shown to be involved in the ulcerative process This connective tissue sends prolongations downward and around the *solitary glands*, thus forming a distinct capsule around them. These glands, which are filled with granular cells, are seen to project with their mouths between the villi into the lumen of the intestine. The solitary glands of the intestine are similar to the glands found in the mucous membrane of the stomach, referred to in the description of Plate XXXVII.

Below the glands the muscular coat of the intestine is represented by a dark band exhibiting longitudinal lines, which indicate the fibres of the involuntary muscle encircling the whole.

The specimen is a carmine staining mounted in balsam, and was prepared by Dr. Seiler.

PLATE XLVIII.

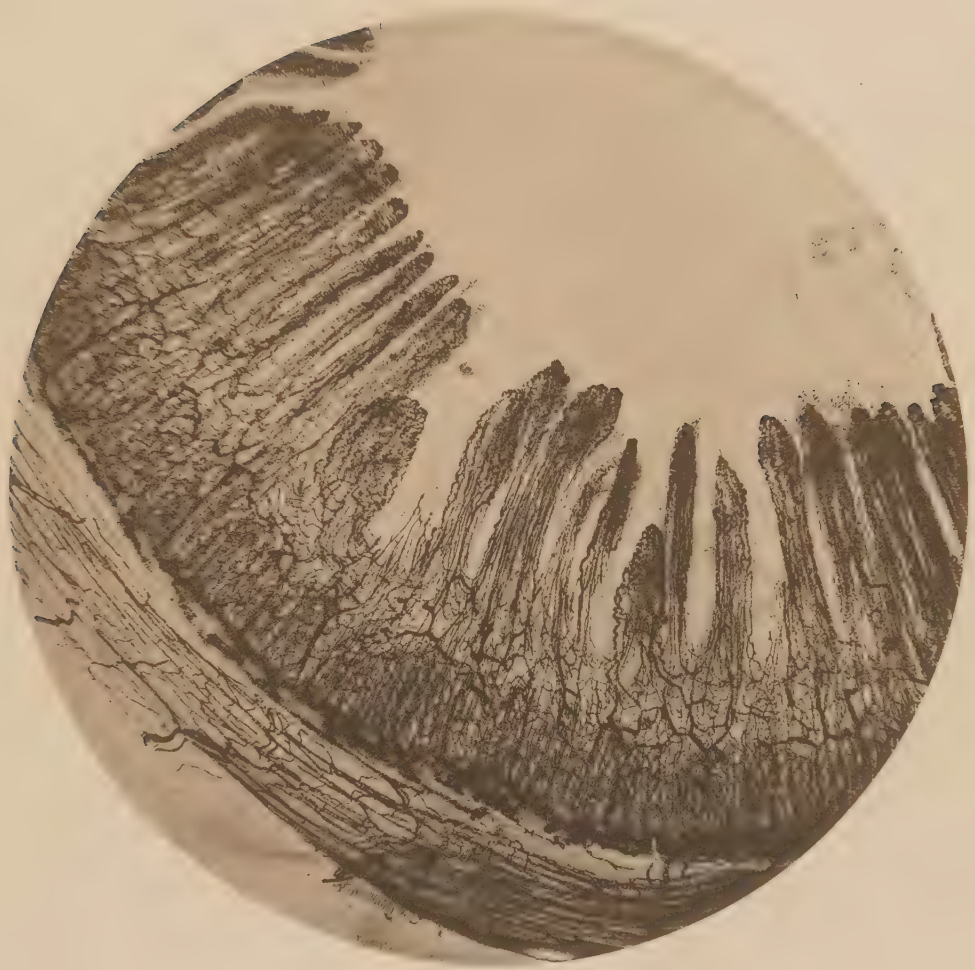
SMALL INTESTINE OF CATS, INJECTED.

This plate exhibits the bloodvessel system of the muscular coat, and the villi of the intestine. It will be seen that each of the villi does not contain merely a single loop of vessels, but a very great quantity of loops, which arch in different planes, thus giving the idea, when viewed under the binocular microscope, as if the vessels were the ribs of a dome. In the centre of this network a lacteal vessel may be observed in specimens prepared so as to bring it to view. Around the villi in the plate the epithelial cells are indicated by a few dots. They could not make an impression upon the sensitive plate owing to their great transparency.

The connective tissue layer is also seen to be very vascular, and it is there that the vessels coming from the villi unite to form larger trunks. The bloodvessel system of the muscular coat seems to be entirely independent of that of the villi and connective tissue.

The specimen is a carmine injection, prepared by Dr, Schaefer of Washington, and is mounted in balsam.

PLATE XLVIII.



SMALL INTESTINE OF CAT. INJECTED.

80 Diameters.

PREPARED BY DR. SCHAEFER.

PHOT., C. SEILER, M.D.

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